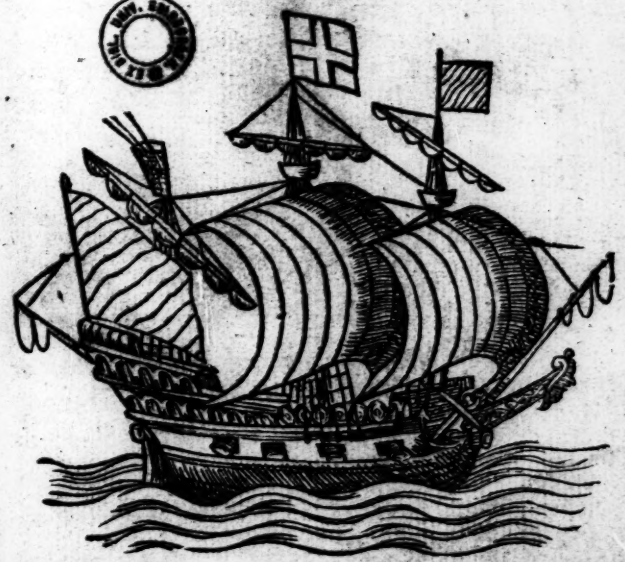
THE ARTE OF NAVIGATION.

First, written in the Spaniſh tongue by that Excellent Mariner and Mathematician of theſe times, MARTINE CVRTIS.

From thence Tranſlated into Engliſh by *Richard Eden*: And now newly corrected and inlarged, with many neceſſarie *Tables, Rules, and Inſtructions, for the more eaſie* attaining to the knowledge of Navigation. By *Iohn Tapp*.



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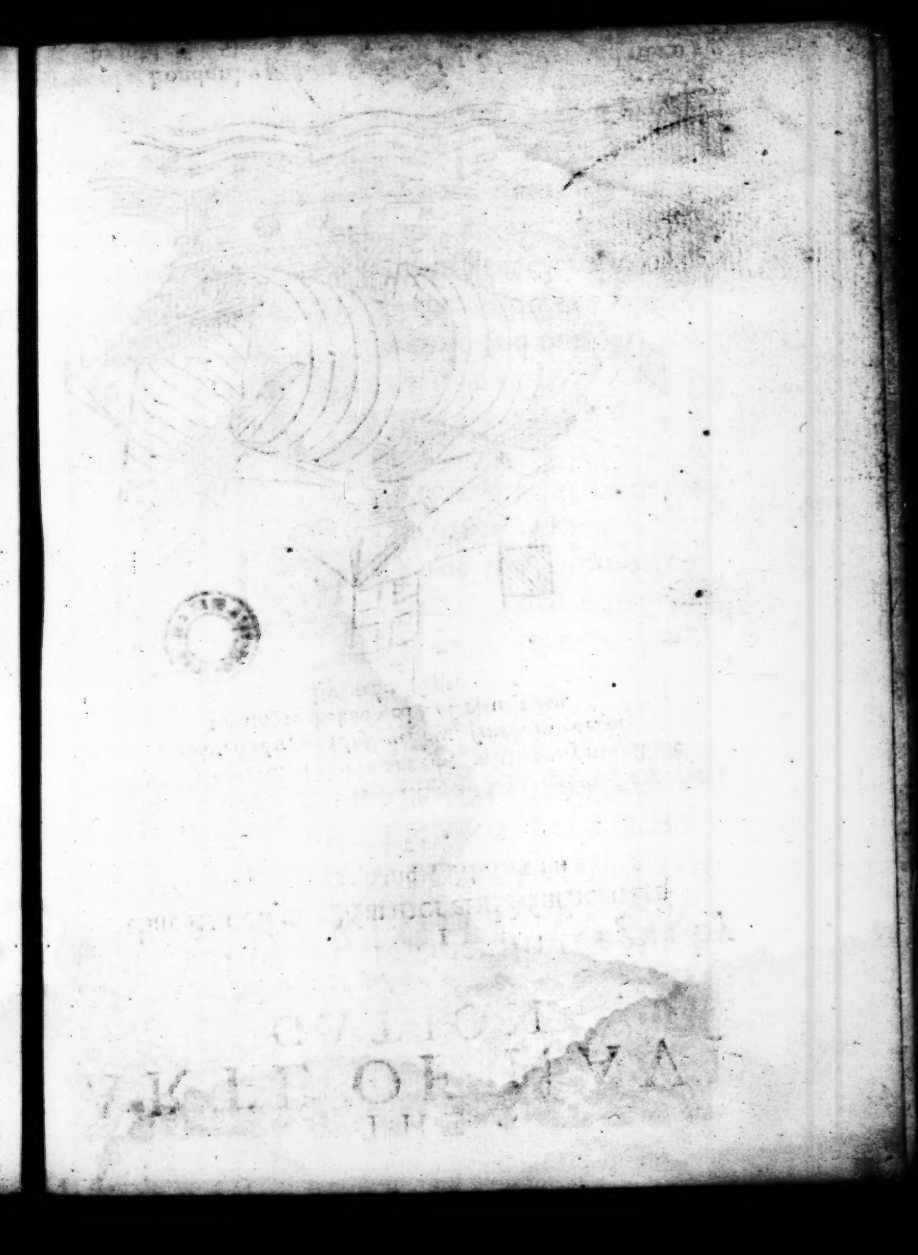


TO THE RIGHT WORSHIPFVL, SIR WILLIAM WADE KNIGHT, LIEVTENANT FOR THE KINGS moſt Excellent Maieſtie, of *his Highneſſe* TOVVER *of* LONDON.

IT is no ſtrange thing, Right Worſhipfull, that Time, the common cõſumer of Antiquity, had welnigh worne out the memorable labours of the firſt worthy Author of this worke, which would (no doubt) haue beene vtterly raked vp in the embers of obliuiouſneſſe, had it any longer ſlept vnder the vaile of obſcuritie. A matter ſoone effected in this cankered decaying age, where the moſt popular part are giuen eyther to glorie in their owne actions, or elſe to depraue others of that prayſe

which rightly doth belong vnto them. I ſpeake not this, as condemning the multiplicitie of bookes extant in this kind; for the Art of Nauigation being ſo excellent to bee practiſed, and the practice ſo commodious to al ſorts of people, there cannot be too much written for the explaning thereof, nor enough ſaid in the commendation of it; the onely thing of which wee are to bee taxed, being, that thoſe worthie Authours, whoſe ancient workes by their painfull labours, haue made plaine pathes, to direct our vnderſtanding, to the knowledge of theſe and manie other worthie Arts, and Sciences, are not ſtill reuiued by their following Diſciples, who haue gained knowledge by their painful endeuours, who ſhould continue their memorie to enſuing poſteritie, among which that haue ſucked ſome ſweetneſſe from the induſtrious labours of former Authours, though leaſt able of manie, yet to auoide that ſcandalous reproch of ingratuitie; I thought it not amiſſe to enter into a reuiew of my firſt Tutor into my matine practices, who though his principles & grounds both of Philoſophie, Aſtronomie, and Nauigation, cannot but bee held authenticall, and might very well paſſe without contradiction; yet Tables being for the moſt part temporary, cannot but in time finiſh

their

their Period, and the whole Tract being now brought to a more neere exactnes, then in those dayes it could be, I endeuoured my selfe by my best meanes, to accommodate and make it fit for the profitable practice of the studious Learners of Nauigation in these times, and to adorne it with such Tables, Rules and Instructions, as I thought fittest for the meanest capacities, which being finished, and readie to passe abroad into the censuring world, where many of *Momus* Disciples are busily prying where they may catch any occasion to cauill; and albeit I might say to some of them, as *Apelles* did to the Carper at his portraict; yet considering that the Authour himselfe dared to craue the protection of an Emperour, and the Translator, of a worshipfull Societie, as both fearing the censuring of such Zoylists; I not thinking my selfe more free from the taxation of contumelious spirits, then any of the former, haue presumed to shrowd both the first Authours workes with my later additions vnder your Worships Patronage; well thinking with my selfe, that hee that is so well addicted to the common good of the Republike, will not denie the protection of that thing, which may any way tend to the profit of the Common-weale in generall. The cause mouing mee to dedicate the

ſame to your Worſhippe, being a ſubiect pertaining to Nauigation, is the euident proof of your Worſhips good minde thereto, in that you are well knowne to bee ſo great a furtherer of that Honourable action of *Virginea*, which may by Gods grace in after-times, proue not onely a direct path to perfection in Nauigation, but ſo commodious to the Republique, that after-ages ſhall haue reaſon to bleſſe the memorie of thoſe worthy perſonages, whoſe great aduentures, and painfull endeuours haue purchaſed a ſecond Common-wealth of profit and pleaſure to enſuing poſteritie, and a Kingdome to themſelues in endleſſe felicity, which wiſhing the beſt thereof to you, and yours, I reſt,

Deuoted to your Worſhips ſeruice,

IOHN TAPP.

COurteous and friendly Readers, you haue here presented vnto your view, the Art of Nauigation, being the gathering and practise of Martin Curtes, a Spaniard, of whose dexteritie and perfection in Marine causes, the worke it selfe is a sufficient witnesse, for that there is no Booke extant in the English tongue, that in so briefe & easie a method, doth discouer so many and rare secrets, both of Philosophie, Astronomie, Cosmographie, and generally, what soeuer doth belong to good and sure Nauigation: but because it hath bin so often imprinted, many faults haue crept into it, through want of ouer seeing and good heed taking, which if they should proceed without correction, it would not onely bee a disgrace vnto the Art (which of it selfe is most commendable) and a discredit vnto the Authour, which is most worthie of commendations, but also it would be a double damage vnto those which should put it in practise, for that some yong Students, not being exercised in the practise of the same, and finding some error therein, might be discouraged to proceed to the knowledge of this most excellent Art.

Therefore for the profit and furtherance of all Sea-faring men, to whom I wish as well as to my selfe, I haue vndertaken to ouerlooke the same, and (according to my small knowledge in that Art) corrected the faults which were gotten thereinto: and besides, knowing how necessarie it would be to haue a Table of the declination of the Sunne: I haue truly calculated one, and added it hereunto, with diuers such Tables, Rules and Collections, which I thought most needfull in this matter, and profitable for thy practise: of all which, if you receiue profit, the Authour is worthily praysed, and I fully satisfied: therefore committing the worke to your studie, and my selfe to your fauorable censure, I take my leaue.

Vale. IOHN TAPP.

How to vſe the next table *following*.

IF you deſire to find in what ſigne of the Zodiacke the ☾ is at any time, firſt reſort to the Kalender, and in the laſt Columne of the moneth vnder the Caracter ☾ of the Moone, directly againſt the day of the moneth, you ſhall find one of the foure and twentie letters: which bearing in memorie, looke the Prime in the page next before, then finding the ſame Prime in the head of this Table, and deſcending by the ſaid Golumne of the Prime, till you find the letter which you beare in memorie, and right againſt the ſame letter in the outmoſt Columne, towards the left hand, is the name of the ſigne, which the ☾ then poſſeſſeth: Example, againſt the firſt of *April*, I find the letter K. and the Prime by the former rule, 1. then going downeward vnder the title, 1. which I find in the head of the Table, till I come to the letter K. againſt the ſame is *Virgo* the deſired ſigne.

A Table wherein is shewed at all times, what signe the Moone shall bee in, by the Prime, and helpe of the letters, in the last Columne of the Kalender, as by the former Example is shewed.

The Prime	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Aries.	y	n	c	b	l	ſt	ſ	h	ʒ	p	e	u	m	a	s	i	ę	q	f
Aries.	ʒ	o	d	u	m	a	s	i	ę	q	f	r	n	b	t	k	ſt	r	g
Taurus.	ę	p	e	r	n	b	t	k	ſt	r	g	y	o	c	b	l	a	ſ	h
Taurus.	ſt	q	f	y	o	c	b	l	a	ſ	h	ʒ	p	d	u	m	b	s	i
Gemini.	a	r	g	ʒ	p	d	u	m	b	s	i	ę	q	e	r	n	c	t	k
Gemini.	b	ſ	h	ę	q	e	r	n	c	t	k	ſt	r	f	y	o	d	b	l
Gemini.	c	s	i	ſt	r	f	y	o	d	b	l	a	ſ	g	ʒ	p	e	u	m
Cancer.	d	t	k	a	ſ	g	ʒ	p	e	u	m	b	s	h	ę	q	f	r	n
Cancer.	e	b	l	b	s	h	ę	q	f	r	n	c	t	i	ſt	r	a	y	o
Leo.	f	u	m	c	t	i	ſt	r	g	y	o	d	b	k	a	ſ	h	ʒ	p
Leo.	g	r	n	d	b	k	a	ſ	h	ʒ	p	e	u	l	b	s	i	ę	q
Leo.	h	y	o	e	u	l	b	s	i	ę	q	f	r	m	c	t	k	ſt	r
Virgo.	i	ʒ	p	f	r	m	c	t	k	ſt	r	g	y	n	d	b	l	a	ſ
Virgo.	k	ę	q	g	y	n	d	b	l	a	ſ	h	ʒ	o	e	u	m	b	s
Libra.	l	ſt	r	h	ʒ	o	e	u	m	b	s	i	ę	p	f	r	n	c	t
Libra.	m	a	ſ	i	ę	p	f	r	n	c	t	k	ſt	q	g	y	o	d	b
Libra.	n	b	s	k	ſt	q	g	y	o	d	b	l	a	r	h	ʒ	p	e	u
Scorpio.	o	c	t	l	a	r	h	ʒ	p	e	u	m	b	ſ	i	ę	q	f	r
Scorpio.	p	d	b	m	b	ſ	i	ę	q	f	r	n	c	s	k	ſt	r	g	y
Sagitarius.	q	e	u	n	c	s	k	ſt	r	g	y	o	d	t	l	a	ſ	h	ʒ
Sagitarius.	r	f	r	o	d	t	l	a	ſ	h	ʒ	p	e	b	m	b	s	i	ę
Capricorn.	ſ	g	y	p	e	b	m	b	s	i	ę	q	t	u	n	c	t	k	ſt
Capricorn.	s	h	ʒ	q	f	u	n	c	t	k	ſt	r	g	r	o	d	b	l	a
Capricorn.	t	i	ę	r	g	r	o	d	b	l	a	ſ	h	y	p	e	u	m	b
Aquarius.	b	k	ſt	ſ	h	y	p	e	u	m	b	s	i	ʒ	q	f	r	n	c
Aquarius.	u	l	a	s	i	ʒ	q	f	r	n	c	t	k	ę	r	g	y	o	d
Piſces.	r	m	b	t	k	ę	r	g	y	o	d	b	l	ſt	ſ	h	ʒ	p	ę
Piſces.	y	n	c	b	l	ſt	ſ	h	ʒ	p	e	u	m	a	s	i	ę	q	f

Hereafter followeth a moſt excellent, neceſſarie and compendious Kalender, ſhewing the Prime, Epact, Dominicall Letter, Leape Yeeres, and Moueable *Feaſts for twentie foure Yeeres.*

Yeere of our Lord.	*Prime.*	*Epact.*	*Sundaie Letter.*	*First Sunday in Lent.*	*Easter day.*	*Ascension day.*	*Whitsunday.*	*Trinitie Sundaie.*
1613	18	18	C	Febru. 21	4	13	23	May. 30
1614	19	29	B	March. 13	24	June. 2	12	June. 19
1615	1	11	A	Febru. 26	9	May. 18	28	4
1616	2	22	G F	18	March. 31	9	19	May. 26
1617	3	3	E	March. 5	April. 20	29	June. 8	June. 15
1618	4	14	D	Febru. 22	5	14	May. 24	May. 31
1619	5	5	C	14	March. 28	6	16	23
1620	6	6	B A	March. 5	April. 16	25	June. 4	June. 11
1621	7	7	G	Febru. 18	April. 1	10	May. 20	May. 27
1622	8	8	F	March. 10	21	30	June. 9	June. 16
1623	9	9	E	2	13	22	1	8
1624	10	20	D C	Febru. 15	March. 28	6	May. 16	May. 23
1625	11	1	B	March. 6	April. 17	26	June. 5	June. 12
1626	12	12	A	Febru. 26	9	18	May. 28	4
1627	13	23	G	March. 11	March. 25	3	13	May. 20
1628	14	4	F E	2	April. 13	22	June. 1	June. 8
1629	15	1	D	Febru. 22	5	14	May. 24	May. 31
1630	16	26	C	9	March. 23	May. 1	11	18
1631	17	7	B	27	April. 10	19	29	June. 5
1632	18	18	A G	18	1	10	20	May. 27
1633	19	9	F	March. 10	April. 21	30	June. 9	June. 16
1634	1	11	E	Febru. 23	6	15	May. 25	1
1635	2	22	D	15	March. 29	7	17	May. 24
1636	3	3	C B	March. 6	April. 17	26	June. 5	June. 12

Dayes.		January.	Length of the dayes.		☾
1	A	New yeeres day.	7 52	a	
2	b	Octa. Stephen	7 55	b	
3	c	Octa. John.	7 58	c	
4	d	Octa. Innocent.	8 0	d	
5	e	Depo. of Edw.	8 3	e	
6	f	Twelfth day.	8 6	f	
7	g	Felix and Janu.	8 8	g	
8	A	Lucian Priest.	8 11	h	
9	b	Joyce Virgin.	8 14	i	
10	c		8 16	k	
11	d	Sol in Aquarius.	8 18	l	
12	e	Atlas.	8 20	m	
13	f	Hilarie Bishop.	8 24	n	
14	g	Felicia.	8 27	o	
15	A	Maurice.	8 30	p	
16	b	Marcell.	8 33	q	
17	c	Depo. of Ant.	8 36	r	
18	d	Prisca Virgin.	8 40	s	4
19	e	Wolfkane Bish.	8 43	s	
20	f	Fabian and Seb	8 46	t	
21	g	Agnes Virgin.	8 50	v	
22	A	Vincent. Mart.	8 53	u	
23	b	Timoth.	9 56	x	
24	c	Emerice.	9 0	y	
25	d	Conuers. of Paul.	9 4	z	
26	e	Polycarp Mart.	9 6	&	
27	f	Chrisost. Doctor.	9 10	ſt	
28	g	Theodore Priest	9 14	a	
29	A	Valerie Bishop.	9 18	b	
30	b	Bateld Quæne.	9 22	c	
31	c	Saturne & Vice.	9 26	d	

Dayes.		February.	Length of the dayes.		☾
1	d	Fast.	9 30	e	
2	e	Purifica. of Marie.	9 32	f	
3	f	Blase Martyr.	9 36	g	
4	g	Gilbert Confes.	9 40	h	
5	A	Agathe Virgin.	9 44	i	
6	b	Dorothe Virgin	9 49	k	
7	c	Angulle.	9 52	l	
8	d	Salomon.	9 56	m	
9	e	Sol in Pisces.	10 0	n	
10	f	Scholastica.	10 4	o	
11	g	Sother Bishop.	10 8	p	
12	A	Eufrase Virgin.	10 10	q	
13	b		10 14	r	
14	c	Valentine.	10 18	ſ	
15	d		10 22	s	
16	e	Julian Virgine.	10 26	t	
17	f	Germaine.	10 30	v	
18	g	Hugh Bishop.	10 34	u	
19	A	Simeon.	10 38	x	
20	b	Hildred.	10 42	y	
21	c	Irrir. Martyrs.	10 46	z	
22	d	Peters chaire.	10 50	&	
23	e	Fast.	10 54	ſt	
24	f	Mathie Apost.	10 58	a	
25	g	Invent. Paul.	11 2	b	
26	A	Nestor.	11 7	c	
27	b	Alexander.	11 12	d	
28	c	Augustine.	11 16	e	

Dayes.		March.	Length of the dayes.		C
1	o	Dauid.	11	24	f
2	e	Chadde.	11	28	g
3	f	Maurice.	11	32	h
4	g	Adrian.	11	36	i
5	A	Focas and Eule.	11	40	k
6	b	Viet and Venin.	11	44	l
7	c	Perpetue.	11	48	m
8	d	Depo. of Felix.	11	52	n
9	e	Foztie Martyzs.	11	56	o
10	f	Agapit.	12	0	p
11	g	Sol in Aries.	12	4	q
12	A	Gregozie bish.	12	8	r
13	b	Theodoze.	12	12	ſ
14	c	Candide.	12	16	s
15	d	Longine.	12	20	t
16	e	Hilla. & Jonaſe.	12	24	v
17	f	Gertude.	12	28	u
18	g	Edward King.	12	32	x
19	A	Joſe. Pa. huſ.	12	36	y
20	b	Cuthbert.	12	40	z
21	c	Benedict.	12	44	&
22	d	Afrodoſe.	12	48	ß
23	e	Theodoze.	12	54	a
24	f	Faſt.	12	58	b
25	g	Annun of Marie.	13	2	c
26	A	Taſtoz Martyz.	13	9	d
27	b	Perciany.	13	10	e
28	c	Rupert.	13	14	f
29	d	Victozine.	13	18	g
30	e	Quirine.	13	22	h
31	f	Adelme.	13	26	i

Dayes.		April.	Length of the day.		C
1	g	Gildard.	13	30	k
2	A	Marie Egypt.	13	34	l
3	b	Richard Bish.	13	38	m
4	c	Ambroſe.	13	42	n
5	d	Vincent.	13	46	o
6	e	Hertus.	13	50	p
7	f	Euphemie.	13	52	q
8	g	Dioniſius.	13	56	r
9	A	Perpetuus.	14	0	ſ
10	b	Apolinia.	14	2	s
11	c	Sol in Taurus.	14	4	t
12	d	Sother.	14	8	v
13	e	Marcus.	14	12	u
14	f	Liburtie.	14	16	x
15	g	Olmond.	14	20	y
16	A	Iſidozie.	14	24	z
17	b	Aniſette.	14	28	&
18	c	Eluthering.	14	32	ß
19	d	Alphage.	14	34	a
20	e	Victoz.	14	38	b
21	f	Simeon.	14	42	c
22	g	Sother.	14	46	d
23	A	George Mart.	14	50	e
24	b	Milfride.	14	54	f
25	c	Marke Euange.	14	56	g
26	d	Clete.	15	0	h
27	e	Anaſtatius.	15	4	i
28	f	Vitalis.	15	8	k
29	g	Peter of Mx.	15	10	l
30	A	Dep. of Erken.	15	14	m

Dayes.		May.	Length of the dayes.	☾	
1	b	Philip and Iacob.	15	18	n
2	c	Athanasius.	15	20	o
3	d	Inv. of the crosse.	15	24	p
4	e	Christopher.	15	28	q
5	f	Godard.	15	30	r
6	g	John Port. Lat.	15	32	s
7	A	John of Beuer.	15	34	s
8	b	Aper. of Micha.	15	36	t
9	c	Trans. of Mic.	15	40	v
10	d	Gordian.	15	42	u
11	e	Anthonie.	15	44	x
12	f	Sol in Gemini.	15	46	y
13	g	Seruilus.	15	49	z
14	A	Boniface Mart.	15	52	e
15	b	Isidore.	15	54	ſ
16	c	Disco. Mart.	15	57	a
17	d	Dunstane.	16	0	b
18	e	Bernardine.	16	2	c
19	f	Aquila.	16	5	d
20	g	Dunstone.	15	8	e
21	A	Barnardine.	16	10	f
22	b	Helena Quéene.	16	12	g
23	c	Desiderii.	16	14	h
24	d	Serule.	1	15	i
25	e	Urbane.	16	16	k
26	f	Adelme confeſſ.	16	18	l
27	g	Bede Prieſt.	16	19	m
28	A	Germaine.	16	20	n
29	b	Cozone.	16	21	o
30	c	Felix.	16	22	p
31	d	Petronil.	16	23	q

Dayes.		Iune.	Length of the dayes.	☾	
1	e	Nichomede.	16	24	r
2	f	Marcell.	16	25	ſ
3	g	Erasmus.	16	26	s
4	A	Petrocus.	16	27	t
5	b	Boniface.	16	28	v
6	c	Melon.	16	29	u
7	d	Paul Bishop.	16	30	x
8	e	Trans. of Edm.	16	30	y
9	f	Ianua. confeſſ.	16	30	z
10	g	Tran. of Wolst.	16	30	ſ
11	A	Barnard Apoſt.	16	30	ſ
12	b	Sol in Cancer.	16	30	a
13	c	Anthonie.	16	30	b
14	d	Basilides.	16	30	c
15	e	Vitc and Mode.	16	29	d
16	f	Tran. of Rich.	16	28	e
17	g	Botolph.	16	28	f
18	A	Mar. & Marcell.	16	27	g
19	b	Gernasius.	16	27	h
20	c	Tran of Edw.	16	26	i
21	d	Walburge.	16	25	k
12	e	Albone.	16	24	l
23	f	Faſt.	16	23	m
24	g	Iohn Baptiſt.	16	22	n
25	A	Amaudi.	16	20	o
26	b	John and Paul.	16	19	p
27	c	Creſcence.	16	18	q
28	d	Faſt.	16	16	r
29	e	Peter and Paul.	16	15	ſ
30	f	Con. of Paul.	16	14	s

Dayes.		Iuly.	Length of the dayes.		
1	g	Octa. of Iohn.	16	12	t
2	A	Visit. of Mary.	16	10	v
3	b	Tran. of Thom.	16	8	u
4	c	Tran. of Mart.	16	5	r
5	d	CCC. Virgines.	16	3	p
6	e	Martialis.	16	2	ꝛ
7	f	Zenane Mart.	16	0	ꝑ
8	g	Depo. of Grem.	15	57	ſt
9	A	Cyril Bishop.	15	54	a
10	b	Dog dayes begin	15	52	b
11	c	Seuen brethren.	15	49	c
12	d	Nabor & Felix.	15	46	d
13	e	Sol in Leo.	15	44	e
14	f	Reuel.	15	42	f
15	g	Transl. Swith.	15	40	g
16	A	Transl. Osmond.	15	37	h
17	b	Katharine.	15	34	i
18	c	Arnulfe.	15	30	k
19	d	Rufian and Just.	15	28	l
20	e	Margaret.	15	24	m
21	f	Prarede.	15	20	n
22	g	Marie Magda.	15	18	o
23	A	Apolinaries.	15	14	p
24	b	Fast.	15	10	q
25	c	Iames Apostle.	15	8	ꝛ
26	d	Anne mot. Ma.	15	4	ſ
27	e	VII I. Slepers	15	0	s
28	f	Sampson.	14	58	t
29	g	Martha.	14	56	v
30	A	Abdon and Sen.	14	54	u
31	b	German.	14	50	r

Dayes.		Auguſt.	Length of the dayes.		
1	c	Lammas.	14	46	p
2	d	Stephen Pop.	14	42	ꝛ
3	e	Inuent. Step.	14	38	ꝑ
4	f	Iustine.	14	34	ſt
5	g	Festum Niuis.	14	32	a
6	A	Transl. of Chri.	14	28	b
7	b	Feast of Iesus.	14	24	c
8	c	Ciriacke.	14	20	d
9	d	Roman Mart.	14	16	e
10	e	Laurence Mart.	14	12	f
11	f	Cuthbert.	14	8	g
12	g	Clarie.	14	4	h
13	A	Yiplit.	14	0	i
14	b	Sol in Virgo.	13	56	k
15	c	Assump. Marie	13	52	l
16	d	Roch Mart.	13	50	m
17	e	Octa. Laurence.	13	46	n
18	f	Leus.	13	42	o
19	g	Barnard.	13	38	p
20	A	Dog dayes end.	13	34	q
21	b	Priuate.	13	30	ꝛ
22	c	Timothe.	13	26	ſ
23	d	Fast.	13	22	s
24	e	Barthol. Apost.	13	18	t
25	f	Lewes King.	13	14	v
26	g	Seuerne.	13	10	u
27	A	Rufine Martyr.	13	8	r
28	b	Augustine Bish.	13	6	ꝑ
29	c	John beheaded.	13	2	ꝛ
30	d	Felix & Audas.	12	58	ꝑ
31	e	Cuthert.	12	54	ſt

Dayes.		September.	Length of the dayes.		☾
1	f	Giles.	12	48	a
2	g	Anthonie Mart.	12	44	b
3	A	Lupus Bishop.	12	40	c
4	b	Trans. Cuthb.	12	36	d
5	c	Bertine.	12	32	e
6	d	Eugenius.	12	28	f
7	e	Natiu. Eliz. Reg.	12	24	g
8	f	Natiu. of Marie	12	20	h
9	g	Gorgonie.	12	16	i
10	A	Siluius Bishop.	12	12	k
11	b	Protect. & Hist.	12	8	l
12	c	Martinian.	12	4	m
13	d	Sol in Libra.	12	0	n
14	e	Holy Crosse.	11	56	o
15	f	Philetus.	11	52	p
16	g	Edith.	11	48	q
17	A	Lambert.	11	44	r
18	b	Vict. and Cor.	11	40	s
19	c	January Mart.	11	36	s
20	d	Fast.	11	32	t
21	e	Matthew Apost.	11	28	v
22	f	Maricius.	11	24	u
23	g	Tecla Virgin.	11	20	x
24	A	Andochius.	11	16	y
25	b	Fermine.	11	12	z
26	c	Sipri and Just.	11	6	ꝛ
27	d	Cosme and Da.	11	2	st
28	e	Exuperius.	10	58	a
39	f	Michael Arch.	10	54	b
30	g	Hierome Priest.	10	50	c

Dayes.		October.	Length of the dayes.		☾
1	A	Remigius.	10	46	d
2	b	Leodegary.	10	42	e
3	c	Candide.	10	38	f
4	d	Francis.	10	34	g
5	e	Apoline.	10	30	h
6	f	Faith.	10	26	i
7	g	Martine.	10	22	k
8	A	Pelagius.	10	18	l
9	b	Gercon & Vic.	10	14	m
10	c	Nicasius.	10	10	n
11	d	Edward King.	10	8	o
12	e	Adorant.	10	4	p
13	f	Calictes.	10	0	q
14	g	Sol in Scorpio.	9	56	r
15	A	Wolfcan.	9	52	s
16	b	Mich. of ye Moũt.	9	48	s
17	c	Etheldred.	9	44	t
18	d	Luke Euangel.	9	40	v
19	e	Fredeswide.	9	36	u
20	f	Austerbert.	9	32	x
21	g	XI. M. Virgins.	9	28	y
22	A	Mary Salom.	9	26	z
23	b	Romaine.	9	22	ꝛ
24	c	Maglory.	9	18	st
25	d	Crispine.	9	14	a
26	e	Ursula.	9	10	b
27	f	Fast.	9	6	c
28	g	Simon and Iude.	9	4	d
29	A	Narcissus.	9	0	e
30	b	German.	8	6	f
31	c	Fast.	8	52	g

Dayes.		November.	Length of the dayes.	☽
1	d	All Saints.	8 50	h
2	e	All Soules.	8 46	i
3	f	Wenefride.	8 43	k
4	g	Amantius.	8 40	l
5	A	Lete Priest.	8 36	m
6	b	Leonard.	8 32	n
7	c	Willibrode.	8 30	o
8	d	Foure crowne.	8 26	p
9	e	Theodore.	8 24	q
10	f	Benet.	8 20	r
11	g	Martine Bish.	8 18	s
12	A	Paterne.	8 16	s
13	b	Sol in Sagit.	8 14	t
14	c	Brandt Erken.	8 11	v
15	d	Machute.	8 8	u
16	e	Depo. Edmond.	8 6	r
17	f	Inic. Reg. Eliz.	8 3	y
18	g	Octa. Marie.	8 0	z
19	A	Eliza. Martyr.	7 58	z
20	b	Edmond King.	7 55	&
21	c	Present. Marie.	7 52	a
22	d	Cecili Virgin.	7 50	b
23	e	Clement.	7 47	c
24	f	Crisogon.	7 45	d
25	g	Katharine.	7 44	e
26	A	Line.	7 42	f
27	b	Agricole.	7 41	g
28	c	Rufus Martyr.	7 40	h
29	d	Satu. ¶ Fast.	7 38	i
30	e	Andrew Apost.	7 37	k

Dayes.		December.	Length of the dayes.	☾
1	f	Eligius.	7 36	l
2	g	Libane.	7 [illegible]	n
3	A	Dep. Osmond.	7 34	n
4	b	Barbara.	7 33	o
5	c	Sana.	7 32	p
6	d	Nicholas Bish.	7 32	q
7	e	Ambrose.	7 31	r
8	f	Conc. of Marie.	7 30	s
9	g	Cyprian.	7 30	s
10	A	Eulalia.	7 30	t
11	b	Damase.	7 30	v
12	c	Sol in Scorpio.	7 30	u
13	d	Luce Virgin.	7 30	r
14	e	Nicasius Bish.	7 30	y
15	f	Valerius.	7 31	z
16	g	Lazarus mort.	7 32	z
17	A	O Sapientia.	7 32	&
18	b	Gratian.	7 32	a
19	c	Venesia Virgi.	7 34	b
20	d	Fast	7 35	c
21	e	Thomas Apost.	7 36	d
22	f	xxx Martyrs.	7 37	e
23	g	Victor.	7 38	f
24	A	Fast.	7 40	g
25	b	Christmas day.	7 41	h
26	c	Stephen Martyr.	7 42	i
27	d	Iohn Euangelist.	7 44	k
28	e	Innocents day.	7 45	l
29	f		7 46	m
30	g	Tran. of James.	7 48	n
31	A	Silvester.	7 50	o

THE FIRST PART OF THIS WORKE, WHICH INTREATETH OF THE COMPOSITION OF THE WORLD, AND OF THE vniuerſall principles for the Art *of Nauigation.*

CHAP. I.

Of the generall diſtinction of *Creatures.*

THe infinite God, the beginning, and cauſe of the whole vniuerſall, created three orders of Creatures, differing in kind: that is to ſay, Corporall, as the Elements: ſpirituall, as Angels: and compounded of theſe two, as Man: The Corporall nature is diuided into bright and ſhining bodies, as the Starres: into darke and thicke bodies, as Earth and Pettals: or into Diaphane or tranſparent bodies, as Ayre & Water. Of theſe creatures (as S. Gregory ſaith) ſome haue only being, as Stones: ſome liue, as Trees: and other haue ſenſe, as Beaſts: other vnderſtanding, as Man: who in holy Scripture is called all Creatures, according to the ſaying of Chriſt to his Diſciples, where he ſaith, Goe & preach the Goſpel to all Creatures. And therefore not without good cauſe was Man called of the Greeke Philoſophers, Microcoſmos,

(that is): the leſſe world. In the which we contemplate things of no leſſe admiration, than in the great world. The ſimilitude betweene them both, is, that euen as the great world, and the whole Globe or Spheare thereof, is moued by the voluntarie motion of an intellectiue ſubſtance, or an Angel: euen ſo is this. For (as Ariſtotle writeth) Whatſoeuer is moued, is moued by vertue of another: As, Man is moued by the internall or inward forme that is within him, (that is to ſay) by the intellectiue ſoule that is proper vnto him. In like manner, in the great world are found diuers moueable things; All which, are reduced to one immoueable mouer. So in man are found many things moued by diuers motions, which are all referred to his intellectiue ſoule. The great world containeth the Creatures within it ſelfe, and conſequently is all really, as hauing nothing without it. Euen ſo man by knowledge is all, and knoweth all things, and nothing naturally is hid from him, or vnknowne to him. Againe, in this leſſe humane world are two motions, Intellectiue, and Senſuall. When conſequently the great world hath two locall motions; the one, wherewith the firſt moueable is moued, and draweth with it all the other Spheares from the Eaſt to the Weſt, and is called Rationall moning. The ſecond, is the mouing of the Spheares, from the Weſt into the Eaſt, and is called Irrationall moning. But now leaning to ſpeake of the leſſe world, we will proceed to ſpeake further of the great.

CHAP. II.
Of the definition of the World.

THe world (as ſaith Iſidorus) is Heauen and earth, and the other workes of God that are contained therein. It is compounded of things viſible, and yet vnſearchable. Moſes and Saint Iohn the Euangeliſt witneſſe that it was made by God. The Philoſophers called it Mundus a mouendo, becauſe it is in continuall moning, and neuer in reſt.

The

The Grekes called it Cosmos, which signifieth, Faire, or Beautifull, and so named it, because of the marueilous ornament thereof, and diuersity of elements, with the resplendence or shining of the Sun, Moone, and Stars. And doubtlesse, nothing may bee seene with the corporall eyes of man more beautiful than it is. In so much that the diuine Philosopher Plato affirmed, that eyes were giuen to men to behold the beautie thereof, and to take pleasure in the contemplation of the heauenly bodies and roundnesse of the world, which also for the roundnes thereof, is called Spheарical, because that Sphæra in the Greeke tongue signifieth a round bodie.

Chap. III.

Of the definition of the Spheare.

Theodosius saith, that the Spheare is a whole and corporall figure, vnder one superficies: in the middest whereof, is a point or pricke, from the which all right lines drawne directly to the circumference, are equall.

This point or pricke, is called the center of the Spheare: according to Euclide, it is the passage of the circumference of halfe a circle, which is turned round about his Diameter that is fixed, vntill it returne to his owne proper place againe, as where it was at the first. By the center of the Spheare passeth the right line, and the extremities or ends thereof touch in the circumference. And this line (imagined) passing through the center is called the Axis, or Axeltree of the Spheare, and the ends thereof are called the Poles. Vpon this Axis is the Spheare of the world moued.

Chap. IIII.

Of the diuision of the World.

It is to be presupposed, that there is difference betweene Element, and Elementate; and the fift, being called,

quinta Essentia. The Quint Essence, or fift substance, is a bodie of it selfe, differing from all Elements, and things Elementall, as well in matter as in forme, and no lesse in nature and vertue: and hauing in it selfe no contrariety, is certainly without corruption. And hereof commeth it, that the Philosophers called the Heauens and Heauenly bodies, the fift substance, or fift Essence, by reason of the incorruptibility therof. Element is that, whereof any thing is compounded. It is the first of compositions, and of it selfe is not compounded. Wherby it followeth, that neyther the Earth, the Ayre, the Water, nor the Fire, ỳ are nére vnto vs, or about vs, are pure and simple Elements. For these Elements doe sometimes mingle themselues one with another, and especially where they are nére together, and touch one another. Of these Elements euery part is named by the name of the whole: As euery part of fire, is called fire, and euery part of earth, is called earth, and so of the other. They are called simple bodies, in respect of other compound and mixt bodies. They are diuisible into parts of diuers formes; and of the commixtion of them, are made & engendred diuers things of sundrie kinds. These foure, (that is to meane, Earth, Ayre, Water, and Fire) although they are named simple, but in respect, as aforesaid, yet are they the Elements (that is to say) beginnings and principles of all other compounds and mixts. A pure Element cannot be séene, forasmuch as that that is pure, lacketh colour; and that that hath no colour, is not visible. The Elements (as sayth Isidorus) were diuided by the hand of God. The Imperiall Heauen was replenished with Angels, the Ayre with birds, the Sea with Fishes, and the Land with men, and other beasts. Elementate, is euery body compounded of the 4. Elements. Not that they are Elements formally, but vertually in mixt bodies. This knowne, we will shew how the world is diuided into two Regions: Celestiall, and Elementall. The Region Elementall, which is continually subiect to alterations, is diuided into foure Elements: which are, Earth, Water,

Ayre,

ayre and Fire. These Elements, the Greekes call Ysogia, for the cõmunion and concord that they haue betwéen themselues. The heauenly or Aetherial region (called Quinta Essentia) cõpasseth & containeth the Elemẽtal world within it.

Chap. V.

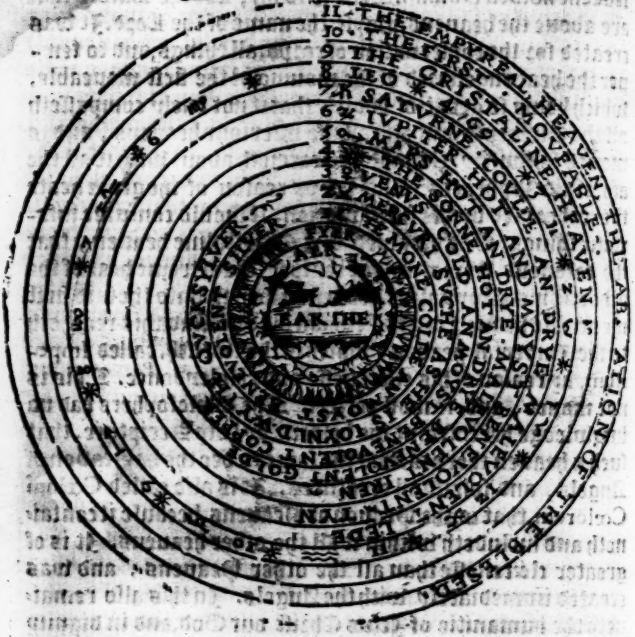
Of the number, order, and propertie of the Elements and Heauens.

The Earth (after the Philosopher) is a pricke or point in the middest, called the center, to the which they assigne the lowest place. Next vnto the earth, and about it, the water occupieth the second place, and the ayre the third. The fire is higher than any of the other Elements. And it is to vnderstand, that the water hath two superficies: One, which is called concaue, or hollow; the other, conuex or embowing. You may compare the inward part of the concaue, to a dish or a bowle, whose outward part is called conuexe. As touching the concaue, the water compasseth about the earth, leauing discouered that part that serueth for the respiration and life of man, and other beasts. As concerning which, some thinke that the Ocean Sea is higher than the Earth, and aske the question, why the Sea couereth not the whole Earth, and why the Earth is not sunke in the Water? To this it may be a sufficient answere, that it hath so pleased the will of God, according to the saying of the Prophet Dauid: Terminum posuisti, quem non transgredietur, neq; conuertetur operire terram: That is, thou hast appointed limits, which it shall not passe, ney ther shall it returne to couer the Earth. Where the will of God, which is the chiefe and efficient cause thereof, we say that Nature faileth not in her necessaries. For she sometime admitteth a little inconuenience, to auoid a greater euill: as when heauie things, which naturally should descend, doe not onely not descend, but rise vp: And as also sometime it chanceth that fire descendeth, and

water ariſeth to fil the void or emptie places, leſt any where ſhould be found void or empty, which Nature ſo greatly abhorreth. To this purpoſe, Nature foreſeeing the kinds of many things that could not elſewhere liue than on the Earth, neyther be conſerued within the water (as men, and other earthly beaſts) determined before to make the Earth not perfectly round, contrary to the nature thereof: wherof it followeth, that it is not altogether couered of the Water. And (as ſaith Origen) the Earth remaineth diſcouered of the water, that it might bring forth fruits, trées, & plants. As touching the couer aforeſaid, the water and earth diſcouered, are contained vnder the concauitie of the ayre, which is diuided into three regions, as the loweſt, higheſt, and middlemoſt. The loweſt is hot, by reaſon of the reflection or rebounding of the beames of the Sunne, ſtricken backe by the earth. The higheſt alſo is hotte, by participation of the fire, and nèreneſſe thereunto. The middle region is cold, as is manifeſt by the ſnow and haile, engendred in the ſame. The Ayre nèere vnto the Region of the fire, which is pure heate, doth neither burne nor lighten, becauſe it hath no combuſtible matter, & ſo hath it power, and not act. It is nère vnto, and reacheth to the circle of the Mone, which compaſſeth it about. The heauen, or circle of the Mone, is next vnto the heauen of Mercurie: and Mercurie vnto Venus: Venus, vnto the Sunne: the Sunne, to Mars: Mars, to Iupiter: Iupiter, to Saturne, which is next, and reacheth vnto the Heauen of the Stars, called the Firmament, becauſe that in it are all the Stars (except the Planets) firme and fixt, as a knot in a Table. The knowledge of the Planets was had by ſeuen ſundrie motions they haue among themſelues, and by their courſe, not vniforme to that of the Stars of the eight heauen, becauſe that ſometimes the Planets appeare vnto vs ioyned together, and ſometimes diuided. The Chryſtaline heauen compaſſeth about, or containeth within it the heauen of Stars. This Chryſtaline heauen is tranſparent, and perſpicuous, as cleare water or glaſſe that may be ſéen through, by

by reason of the clérenesse and pure substance thereof. It is by another name called, the heauen of water, whereof holy Scripture speaketh, saying, Aquæ quæ supra cœlos sunt, laudent nomen Domini. That is to say, Let the waters that are aboue the heauens, prayse the name of the Lord. It was created for the conseruation of corporall things, and to temper the heat engendred of the mouing of the first moueable, which being so great of bodie, that it not onely compasseth all the Elements, but also all the inferiour heauens, and is moued so swiftly, that it daily carrieth about with it all the aforesaid Spheares. And lest by reason of the great heate thereof caused by his swift motion, it should consume inferiour things, God ordained this Chrystaline heauen, that the coldnesse thereof might temper the extreme heat of the other. This Chrystaline heauen reacheth vnto the said first moueable heauen, called Primum mobile. And this reacheth to the Imperial heauen, which is the twelfth, called Imperium, by reason of his clérenesse and resplendence. This is not moued, and is most perfect. The Philosophers had no knowledge hereof. But we beleeue by holy Scripture, that such a heauen there is, and the same to bee the habitation of Angels, and spirituall creatures. It is also called Cœlum Cœlorum, that is, the Heauen of Heauens, because it containeth and includeth within it all the other heauens. It is of greater clérenesse than all the other Heauens, and was created immediately with the Angels. In this also remaineth the humanitie of Iesus Christ our God, and in dignity aboue it. It containeth three holy orders or principalities, called Hierarchies. Whereof the first is called Supercelestiall, and hath in it also three orders, Seraphims, Cherubims, and Thrones. The second is called Celestiall, and containeth Dominions, Principates, and Potestates. The third, called Subcelestiall, containeth Vertues, Archangels, and Angels. And to conclude, it hath abundance of all goodnesse and perfect felicitie, with priuation or want of all euill. The Heauen also giueth influence of constancie, stedfastnesse and durabili-

rabilitie to things, against the fluxibilitie and inconstancie of the other heauens: the order whereof doth appeare in the demonstration following.



Chap. VI.

Of the immutabilitie, or immobilitie of the Earth.

The Pythagorians and other Ancient naturall Philosophers (as sayth Aristotle) were of opinion that the Earth did moue, yet not by a right-forth motion, but circularly about the middest of one place. The which errour, both

Aristotle

Aristotle himselfe, and the Astronomers doe confute, and repvone by euident causes, and manifest demonstrations: For circular motion is proper to the Heauens. And as the Earth differeth from them in nature, so likewise in moving. And although it be so, that the Earth may naturally moue by certaine of his parts, yet to moue in the whole, and without the circuit of his Spheare, it is impossible, being founded and established vpon his owne Center, the which of it selfe is naturally immoueable: for as much as in it the reason of all heauines consisteth. Whereas otherwise, euery part that is moued should ascend, contrarie to the nature of all heauie things. But there is found nothing heauie that doth not naturally encline directly to the center of the Earth, and would actually descend thither, if it had no impediment of some other thing to resist it: and when it toucheth there, or is come thither, would still rest and remaine there. And hereby it followeth, that the Earth, being founded vpon his own Center, is not moued. The which thing the Prophet Dauid also affirmeth, saying, Fundasti terram super stabilitatem suam (that is) Thou foundest the Earth vpon his stabilitie.

CHAP. VII.

Of the roundnesse of the Earth and Water.

That the Earth is round, it appeareth by manifest euidence: for if it were plaine or flat, the dawning of the day or day-spring, should equally and at one time appeare to them in the West, as to them in the East. But we see the contrarie, that it appeareth first to them that dwell in the East, and afterward to them in the West. This is proued by the Eclipse of the Mone, which beginning at one instant, they of Hierusalem see it begin at tenne a clocke of the night. And we of London in England, at one a clocke in the morning. It followeth hereby, that to them it lighteneth three houres sooner then vnto vs in England: and this is caused by the roundnesse of the Earth. It is also as well knowne to

be

bee round from the pole Artycke, to the pole Antartycke: for by the roundneſſe thereof, is cauſed the equality, and inequalitie of the dayes and nights. The ſame is likewiſe knowne by the raiſing of the Pole aboue our Horizon. And that the ſuperficiall part of the Earth and Water, is all one round and Sphearicall Globe, is manifeſt by the ſhadow thereof, being a certaine darke bodie, reflected from the Earth in the Eclypſe of the Mone. For by this, as by plaine demonſtration, may wee know that the Earth is round, as may more manifeſtly appeare by this Figure. It is alſo proued, that the water is a round body, as is ſeene by experience. For if you erect a marke vpon the Sea banke of a Port, and a Ship depart from that Port a certaine ſpace, then ſtanding in the Poupe or Sterne of the Shippe, you ſhall not ſée the marke aforeſaid: but if you ſtand in the top of the Shippe, then may you ſée it. Whereas notwithſtanding (if that portion of the bending Arch of the earth did not hinder the ſight) you ſhould ſée it better being in the Poupe, for as much as it is nérer to the marke, than to the toppe of the Shippe, as by this demonſtration following, appeareth.

But

But here some may move a doubt, saying, that on the earth we may see many mountaines, and consequently many great Valleyes and Plaines, with many diversities of sundry other deepe and unequall places, by reason whereof, the earth cannot truly be called round. To this I say, that in two manners, the earth is called and understood to bee round: as after one manner, speaking precisely, it is called round, as a Circle or a Sphere, which we call round, because that all right lines drawne from the center thereof to the circumference, are equall: the other roundnesse, is considered without this precisenesse; and is such, as not by all his parts is equally distant from his middest or center, but hath some parts higher, and some lower, yet not in such quantity as may destroy the roundnes of the whole. As if in a Bowle there were certaine clifts or holes, it should not thereby leane to be round, although not perfectly or precisely round. And for this cause saith Auerrois, that although both the heauenly bodies and the Elements are of round forme, yet differ they in this, that the heauenly Spheres haue perfect roundnesse, and the elements not. As the earth, by reason of his Mountains and Valleys, the Sea by his increasing, and decreasing: the ayre also for his neerenesse to the fire, and by his contrariety doth sometime do, and sometime suffer (that is to say) is sometime active, and sometime passiue. So that following the one, it fleeth the other, by reason whereof, it also lacketh perfect roundnesse. But the fire, for as much as it

is

is neere to the concaue of the Circle of the Mone, which is Spherical, may therefore be called Spherical or round.

Chap. VIII.
Of the motion of the Heauens and Elements.

It is not to be forgotten, that all the Elements are wholy moueable by locall motion, except the Earth. The Water is moued by the motion of the Mone, or tolled by the Windes. The fire (as sayth Aristotle) is moued circularly by the motion of the day, and is drawne of the Circles that embrace, or compasse it about: as is manifest by the Cometes, or Blazing Starres, and other fierie exhalations, contained and engendred in it: which being carried with this motion, conclude, that the fire moueth in like manner. And with this motion is the superiour part of the Ayre violently carried about, as the other impressions therein doe shew. The inferiour part is moued by diuers motions (that is to meane) laterally, as by experience wee see, when the windes blow. The Mone with her Heauen or Spheare, by her proper motion giueth her turne from the West to the East, in fir and twentie dayes, and seuen houres, with fifteene minutes: Venus, Mercurie, and the Sunne, in a yeere, which is the space of three hundred, threescore and fiue dayes, with fiue houres, and fortie and nine minutes. Mars in two yeeres: Iupiter in twelue yeeres. Saturne in thirtie yeeres. The eight Heauen, which is the Firmament, or starrie Heauen, by his owne proper motion is moued by the ninth Heauen: vpon the beginning of Aries and Libra, and vpon these two points accomplisheth his Reuolution in seuen thousand yeeres.

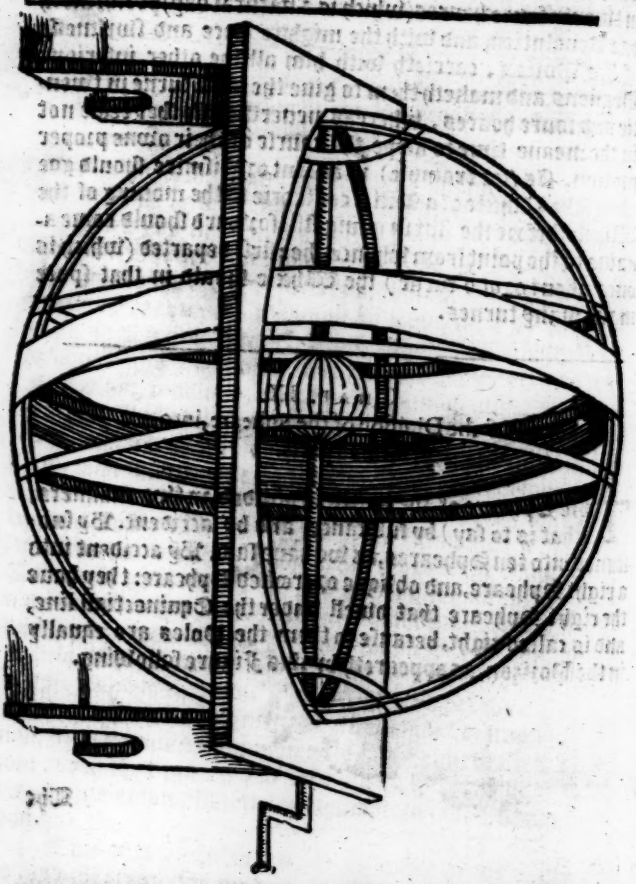
This motion is called Motus trepidationis (that is to say) the trembling motion, or motion of accesse and recesse. The ninth Heauen endeth his motion from the West to the East, in fortie and nine thousand yeeres: And by this motion

motion moueth the eight Heauen. The tenth Heauen, called Primum Mobile, is moued from the East to the West, and in twenty foure houres (which is a natural day) perfourmeth one Reuolution, and with the mightie force and swiftnesse of his motion, carrieth with him all the other inferiour Heauens, and maketh them to giue the same turne in twentie and foure houres, whereas neuertheleſſe they ceaſe not in the meane time to kéepe the course of their owne proper motion. As (for example) if an Ant or Pismire should goe about the Whéele of a Mill, contrarie to the moning of the Whéele: before the Ant in going still forward should come againe to the point from whence shee first departed (which is ones about or one turne) the Whéele should in that space make many turnes.

CHAP. IX.
Of the Diuision of the Spheare, into formall parts.

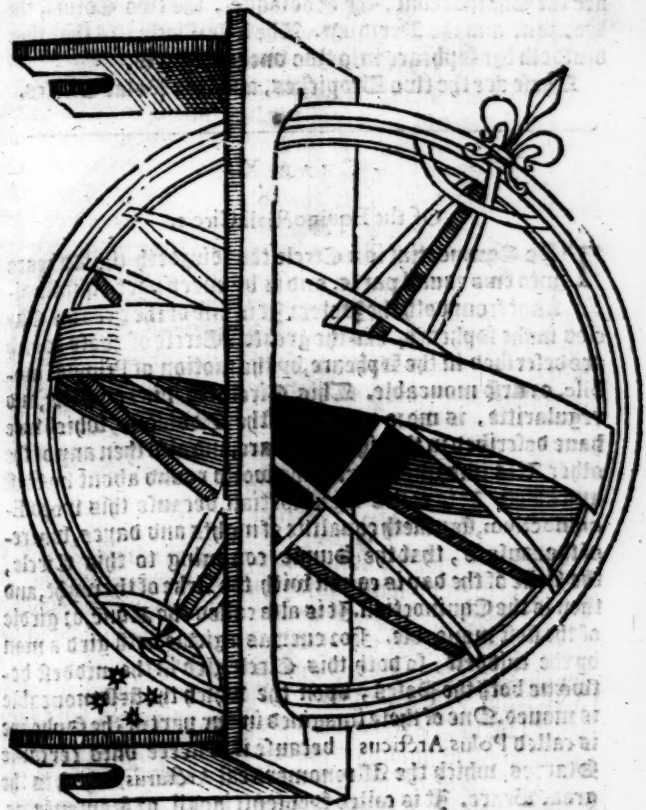
THe Spheare of the world is diuided in two manners, (that is to say) by substance, and by accident. By substance into ten Spheares, as we haue said. By accident into a right Spheare, and oblique or crooked Spheare: they haue the right Spheare that dwell vnder the Equinoctiall line, and is called right, because to them the Poles are equally in the Horizon, as appeareth by this Figure following.

The



They haue the oblique Sphearе that dwell eyther on this side or the other side of the Equinoctiall, vnto whom is

is euer one of the Poles aboue the Horizon, and the other vnder it, as appeareth in this Figure.



This Sphеare is compounded of ten Circles imagined. And (as saith Iohn de Sacro bosco in his Booke of the

Sphearc) six of them are greater, and foure lesse. The greater Circle, is that which diuideth the Sphearc into two equal parts, and hath his Center with the Center of it. These are the Equinoctiall, the Zodiaque, the two Coluri, the Horizon, and the Meridian. The lesse Circle, is that that diuideth the Sphearc into two vnequall parts.

These are the two Tropickes, and two Polar Circles.

Chap. X.

Of the Equinoctiall Circle.

The Equinoctial is a Circle that diuideth the Sphearc into two equall parts, and is by euery part equally distant from both the Poles: It is one of the greater Circles in the Sphearc, & is the greatest Circle of those which are described in the Sphearc, by the motion of Primum mobile, or first moueable. This Circle for his equalitie, and regularitie, is more noble then the Zodiaque, which we haue described in the eight Sphearc, and also then any of the other. It is imagined to gird the world round about by East and West. It is called Equinoctiall, because this word Equinoctium, signifieth equalitie of nights and dayes, whereof the cause is, that the Sunne comming to this Circle, the Arke of the day is equall with the Arke of the night, and then is the Equinoctiall. It is also called the Zone, or girdle of the first moueable. For euen as a girdle doth gird a man by the middest, so doth this Circle gird in the middest betweene both the Poles, vpon the which the first moueable is moued. One of these imagined in our part of the Sphearc is called Polus Arcticus, because it is neere vnto certaine Starres, which the Astronomers cal Arcturus, which is the great Beare. It is called Septentrionall, or Septentrine, because that round about it are moued the 7. starres which make the lesse Beare, commonly called Bootes (that is) the Horse: the starre which is in the taple of the lesse Beare,

is

is called the North Starre, because it is nérer vnto the North Pole: the which Pole is a certaine point in the Firmament which cannot be séene, although the night bee neuer so cleere. This Starre (as the Poet Homer sayth) doth moue little or nothing, because of his little distance from the Pole. The other Pole is imagined on the other contraris part, and is called Polus Antarticus, of the word Anti, which signifieth against, contrarie, or opposite, because it is on the contrarie part from the Pole Artike. It is also called the South Pole, because that from that part of heauen commeth the Wind, commonly called the South, and is likewise called Meridionall, because it is right South from vs. This is neuer séene to vs; they that dwell vnder the Equinoctiall, or come nére vnto this Pole Antartike, haue for a signe or marke to know it, foure Starres, in forme of a Crosse. And when the greatest of these is lowest in the foote of the Crosse, they say it is 30. degrées aboue the Pole. And as we cannot sée their Pole from hence, so they cannot sée our Pole from thence.

Chap. XI.
Of the Zodiacke Circle.

The Zodiacke is defined to decline or bend it selfe from the Equinoctiall. It is a great Circle, which deuideth the Spheare, in two equall parts, cutting the Equinoctial by oblique or crooked Angles: so that being thus cut or deuided by it into two equall parts, one part thereof declineth towards the South, and the other toward North. This Circle is called the Zodiacke, of this word Zoee, which in the Greek tongue signifieth life, because that according to the moning of the Planets vnder it, is the life of inferiour Creatures: Or is so named of Zodion, which signifieth a liuing Beast, and is therefore deuided into twelue equall partes, whereof euery part is called a Signe, and euery Signe hath an especiall name of some Beast, in respect of some propertie agree-

able to the same: or for the order and disposition of the first Stars in those parts, somewhat representing the similitudes of such beasts, it is called Zodiacke. The Latines called this Circle, Signifer (that is) the Signe-bearer; because it carrieth these Signes or Images in it, also because the twelue parts, into the which this Circle is diuided, are called the twelue Signes. The part which declineth to the North, containeth fiue Signes Septentrional, and the other that declineth to the South, containeth other fiue, called Meridionall. Furthermore, it is to consider, that the Zodiacke may bee deuided in two manners. One, by Longitude or length into the twelue Signes aforesaid, and euery signe is diuided into 30. degrées, which make 360. degrées, likewise euery degrée is deuided into 60. minutes, and euery minute into 60. seconds, and euery second into 60. thirds, and so to ten. The other deuision of the Zodiacke is, by Latitude or breadth. By Latitude it is diuided into 12. degrees, and in it wee imagine a line that diuideth his Latitude by the middest, hauing fiue degrées on euery part or side. And this line which diuideth into two equall parts, the breadth or Latitude of the Zodiacke, is called the Ecliptick line, because that when the Sun and Mone are directly vnder this line, either ioyned together by coniunction, or diuided by opposition, then is the Eclipse of the Sun or of the Mone. Vnder this Zodiacke the 7. Planets are moued. The Sun also moueth in the midst of the said Zodiacke, alongst the Eclipticke line, not inclining more to the one part then to the other. But the other Planets doe sometime goe toward the North, and otherwhiles toward the South, and sometime also toward or trauerse the Eclipticke. It is likewise to be noted, that these Signes whereof we haue spoken, are not the Constellations or Stars that make those figures, which the ancient Astronomers did appropriate to certaine beasts and other things. For these figures are moued according to the motion of the eighth Sphere, and passe from one Signe of the Zodiacke to another: As wée sée that the Star, called Oculus Tauri, (that is) the Buls Eye, is in

three degrées, 42'. of Gemini. And the two Starrs that are the head of Gemini, are in 13. and 16. degrées of Cancer. And Spica Virginis (that is) the Spike of the Virgine is in seuentéene degrees, 42'. of Libra, and the heart of Scorpio in three degrees, 42'. of Sagitarius. And by this order doe they passe from one Signe to another: so that wee may not vnderstand the Signes by these Starrs, but the 12. partes of the Arch of the Zodiacke, taking the beginning of the Equinoctiall of Aries. The names of these Signes, with their Characters and qualities, are described in this Table here following.

Numb.	*Names.*	*Charact.*	*Qualities.*
1	Aries.	♈	Hote and drie.
2	Taurus.	♉	Colde and drie.
3	Gemi.	♊	Hote and moist.
4	Cancer.	♋	Colde and moist.
5	Leo.	♌	Hote and drie.
6	Virgo.	♍	Colde and drie.
7	Libra.	♎	Hote and moist.
8	Scorpio	♏	Colde and moist.
9	Sagita.	♐	Hote and drie.
10	Capri.	♑	Colde and drie.
11	Aqua.	♒	Hote and moist.
12	Pisces.	♓	Colde and moist.

Chap. XII.

Of the Circles called *Coluri*.

There are two Circles in the Spheare, called Coluri, so named of the Greéke word Colon, which signifieth a member: And of Vros, which signifieth a wilde Dre. The tayle of this Beast, maketh a Semicircle or halfe Circle, not perfect. And as this Beast moueth his tayle laterally or side wayes, and not by Longitude: euen so doe the Coluri moue to vs, and are cut in right sphericall Angles, vpon

the Poles of the World. The one passeth by the Poles of the World, and by the points of the Equinoctials, and is called the Equinoctiall Colure; the other likewise passeth by the Poles of the World, and also by the Poles of the Zodiacke, and by the points of the Solsticials, and is called the Colure Solsticial, called Solsticium, or Solis Statio (that is) the standing or staying of the Sun, because that when the Sun commeth to this point, it declineth no more, but turneth toward the Equinoctiall. These Circles deuide aswell the Equinoctiall as the Zodiacke into foure equall parts, by the points of the Equinoctials, and Solsticials. In the Colure Solsticiall, are the greatest declinations of the Zodiacke, which are two Arches of this Colure, contained betweene the Equinoctiall and the Zodiacke. And these Arches are equall to the other two of the same Colure, included betweene the Poles of the World, and the Poles of the Zodiacke.

Chap. XIII.
Of the Meridian Circle.

The Meridian is one of the great Circles, imagined to trauerse the Sphere by the Poles of the World, cutting the same in two equal parts by the Zenith or vertical point: It is called Meridian, for this effect, that whersoeuer a man becommeth, and at whatsoeuer time of the yere, when the Sun (by the moving of the first moueable) shall come to the Meridian, to him shall it bee high noone at mid-day, and is therefore also called the Circle of the mid day. It is also to be noted, that there are as many Meridians, or Meridian lines, as are differences or habitations by Longitude, so that they that dwell in the East, haue other Meridians then they that dwell in the West: so that the interposition of the Arch of the Equinoctiall, betweene the Meridian of one Citie, and the Meridian of the other, is called the difference of Longitude from one Region to another, and from one Citie to another, as we will further declare hereafter.

Chap.

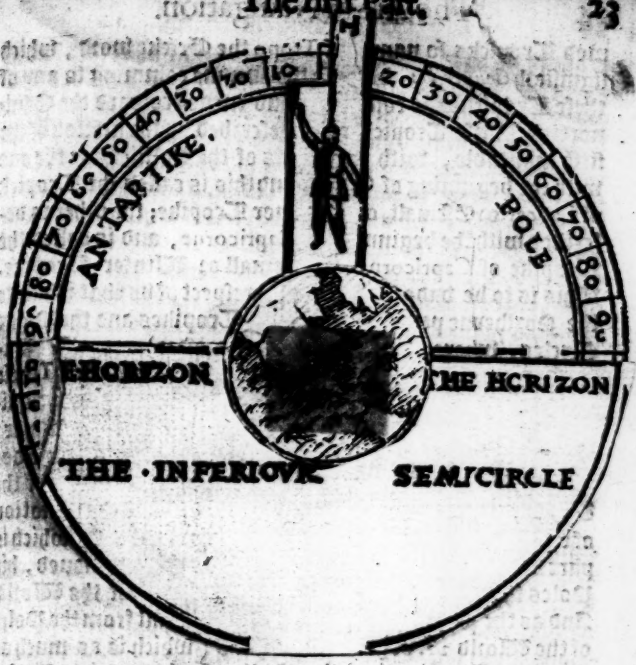
Chap. XIIII.

Of the Horizontall Circle.

THe Horizon (after the Astronomers) is a Circle which deuideth that part of the Heauen which we doe see, from the other part which we see not, so that the said Horizon deuideth the Sphere of the world into two equall halfes, called Hemispheres. The halfe which we doe see, is called the Hemisphere superiour, and it which we see not, is called the Hemisphere inferiour. This Horizon changeth to them that moue: for as one doth moue, his Horizon doth change. And hereof it commeth, that how many places are vpon ỹ earth, and the circumference thereof, it is possible there should be so many Horizons. The Astronomers suppose the Horizon after two manner of sorts, that is to say, a right Horizon, and an oblique, or crooked Horizon. The right Horizon is to them, whose Zenith or vertical point is directly in ỹ Equinoctiall: and this right Horizon passeth by the Poles of the World, and diuideth the Equinoctiall in right spherical Angles. The other oblique or declined Horizon haue they, vnto whom the Pole of the World doth rise aboue their Horizon. This Horizon is also called oblique, because it diuideth the Equinoctiall in vnequall, (as obtuse, or acute) Angles.

Also it is to be vnderstood, that the Pole of the Horizon is called Zenith, or the verticall point of Heauen, perpendicularly, or directly ouer our head. Whereby is inferred, that as much as is the eleuation of the Pole of the World aboue the Horizon, so much is the distance of the Zenith from the Equinoctiall. For the Zenith by all his parts, is distant from the Horizon by ninetie degrees. And all other impediments excluded, we may euer see halfe the Heauen: And in as much as any shall passe from the Equinoctiall towardes the one Pole or the other, so much falleth the Horizon vnder or beneath the Pole, toward the course he intendeth, and likewise as much shall it bee raysed aboue the contrarie Pole, as shall appeare by a demonstration in the end of this Chapter.

This Horizon is diuided by the Meridian into two equall parts: that is to say, the East and West partes of the said Horizon. The East part is, where the Sunne and Starres begin to arise to vs, and appeare in our sight: the West part is, where the Sunne and Starres doe set, and begin to be hid out of our sight, vnder the said Horizon: moreouer it is to bee vnderstood, that there bee two manners of the East and West, that is to say, the true East and West, or the vntrue. The true East, is the point in the East part of the Horizon, where it doth cut with the Equinoctial: for when the Sunne is in the points of the Equinoctial, then he riseth in the point of the true East. And likewise is to bee vnderstood of the point of the true West, to bee in the West part of the Horizon, where the Equinoctiall doth cut with the said Horizon. The vntrue East and West is variable, according as the Sunne riseth and setteth daily in diuers points of the Horizon, which is distant from the points of the true East and West, sometimes more to the Northward, and sometimes more to the South: which said distance of the Sunne, Mone, or Starres rising from the true East or West, is called the amplitude thereof: for like how many degrées that the Sunne, Mone or Stars rise or set, eyther to the Northward or Southward of the true East and West, so much is the amplitude thereof said to be. From the Horizon is accounted all degrées of Elenation or Altitude towards the Zenith, also vpon the Horizon are distinguished the 32. points of the Mariners Compasse, of which more particularly is afterward spoken: and for the better explaning of the said Horizon Circle, behold this Figure, where you see, that when the two Poles are in the Horizon, then is the Equinoctiall in the Zenith or right ouer your head, and then are both the Poles in your sight: but if you depart from the Equinoctial towards eyther of the Poles, then like how much your Zenith is from the Equinoctial, so much is the Pole elenated aboue your Horizon, as this said Figure more plainely sheweth.



Chap. XV.

Of the foure lesse Circles.

HAuing intreated of the six biggest Circles, it remaineth to speake of the foure lesse Circles.

A lesse Circle (as wee haue said before) is that, whose superficiall deuideth the Sphere into vnequall parts, not passing by the Center thereof. And of these, two are na-

med Tropicks, so named of Tropo the Greeke word, which signifieth *Conuersion*, because the Sunne comming to any of these Tropickes, is conuerted and turned toward the Equinoctiall. These Tropickes, are described by the motion of the first moueable, with the points of the Solsticials: the one with the beginning of Cancer, and this is called the Tropick of Cancer, or Estiuall, or Summer Tropike; the other is described with the beginning of Capricorne, and is called the Tropike of Capricorne, or Hiemall or Winter Tropike. This is to be vnderstood to bee in respect of vs that inhabite the Northerne parts. These two Tropikes and the Polar Circles, (whereof I will speake hereafter) are called Paralels, so named, for [illegible] equally distant, by their circumferences one from [illegible], alwell as from the Equinoctiall. The Polar Circles are described in this manner: that as the Zodiake declineth from the Equinoctiall, so doe the Poles of the Zodiacke decline from the Poles of the World. And as the eighth Sphere is moued at the motion of the first moueable, so shall the Zodiacke moue, which is part of the Sphere. And the Zodiacke being moued, his Poles shall likewise moue about the Poles of the World. And as the Poles of the Zodiacke are distant from the Poles of the World 23. degrees and a halfe (which is as much as the greatest declination) they shall describe certaine Circles distant from the Poles of the World, in the selfe same 23. degrees, and a halfe: these Polar Circles take their name of dominion of that Pole of the World, that is most neere vnto them, & therefore is the one called Artike, and the other Antartike: the Artike is the North Pole, being that which is apparant to those which are to the Northward of the Equinoctiall, and the Antartike is the South or opposite thereto.

Chap. XVI.

Of the fiue Zones.

The ancient Astronomers diuided the Sphere into fiue Zones: the first from the Pole Artike, to the Cir-

cle

ne Artike. The 2. from the Circle Artike, to the Tropike of Cancer. The 3. from the Tropike of Cancer, to the Tropike of Capricorne. The 4. from the Tropike of Capricorne, to the circle Antartik: the 5. from the Circle Antartike, to the Pole Antartike. Of these 5. Zones they haue certaine knowledge, that 2. of the Poles were vnhabitable for extreme cold: and also that the burnt Zone (called Torrida Zona) whereby the Sunne passeth by the middest of them, should be vnhabitable for extreme heat. That from the Tropike of Capricorne, vnto the circle Antartike, they called desert, because they knew not that it was inhabited. And this our Zone, that is, from the Tropike of Cancer, to the circle Artike, they called inhabited or habitable: and to haue more perfect knowledge hereof, it is to imagine, that the Earth is diuided proportionally into fiue regions or portions, which answere directly to the said fiue Zones, as saith the Poet Ouid in this Verse:

Totidemque plagæ tellure premuntur. (That is)

And so many Regions are on the Earth beneath.

Euery of these Regions or portions of the Earth, is situate vnder one of the fiue Zones afore said. But whereas certaine men of authoritie haue moued the question, whether the Earth vnder the Zone, from the Tropike of Cancer, to the circle Antartike, is desert or no: Ptolomie and the Astronomers affirme, that it is vnpeopled. But Aristotle and Ouid in the second of his Metamorphosis: Plinie also and Iohn de sacro Bosco, affirme the contrary: as for the more certainty thereof, we know the experience of such as go and come daily from those parts. Moreouer then this, we know that that Land is not onely well replenished with people of good corporature, and of white colour, but the same to be also very rich in gold. For they that sayle to the East Indies, touch in the Cape of Buena Speranza, or Caput bonæ Spei, which is in this Zone. Likewise the Land of Brasile, and the confines of Rio de la Plato, with all the Coast vnto the Straights of Magalanes, euen vnto 54. degrées of South. This Land was discouered by Magalanes, in the yere 1520. or 1521. whereby that is

now

now well knowne by sight, whereof Ptolomie had no knowledge by hearesay. The burnt Zone (called Torrida Zona) they also described to be vnhabitable, by reason of the great heat thereof, as Aristotle, Plinie, and in manner all other ancient Authors affirme, whereof the Poet Virgil writeth thus,

Quinque tenent cœlum Zonæ, quarum vna coruſco,
Semper ſole rubens, & torrida ſemper ab igne.

Which in the English tongue is thus much to say in effect:

In Zones fiue, the Heauens contained be,
Whereof the one with burning Sunne is red,
Scorching the Earth subiect to his degree,
That for the heate thereof it is vnhabited.

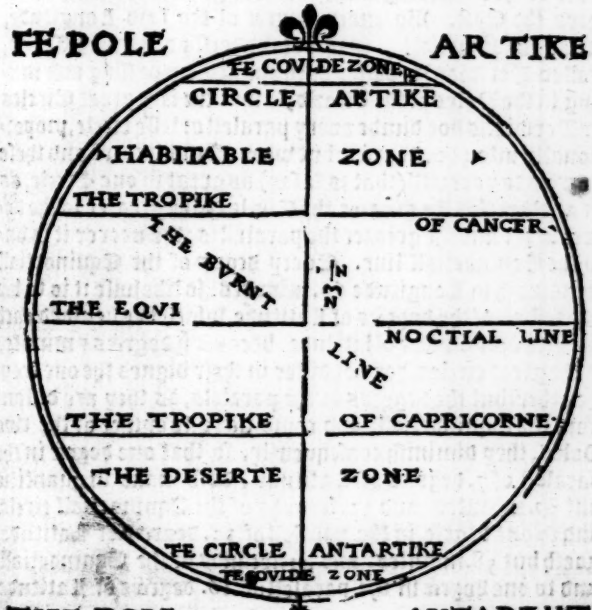
Likewise Ouid in his Metamorphosis, toucheth the same, saying,

Quarum quæ media eſt, & torrida ſemper ab igne, &c.

Yet that the burnt Zone is inhabited, and well replenished with people that liue there, we know so certainely by the number of them that dayly passe to and fro from the Indies, that, to say any thing to the contrary, it should be a manifest errour, and therefore it is greatly to be marualled, that certaine wisemen haue affirmed these parts to be vnhabitable; whereas neuertheless they had knowledge of Arabia Fœlix, Æthiopia, Taprobana, and diuers other Regions situate vnder the burnt Zone. Plinie writeth, that a Ship came from the Sea of Persia by the Ocean, round about Ethiope, and came to the pillars of Hercules, which is now the Citie of Cadiz, where at this present I writ this briefe Treatise. They of Guinea, Calicut, Gatigara, and Malaca, liue all vnder the burnt Zone, and many of them liue verie long: And doubtlesse, many things ought to perswade vs, that vnder the burnt Zone, the Earth is furnished with all things pertaining to the life of man: for that in that Region, or portion of the Earth, is in manner continuall Equinoctiall, or equalitie of dayes and nights, whereby the coldnesse of the night doth sufficiently temper the heate of the day: againe, they that inhabite vnder that Zone, haue two Sommers and

two

two Winters in the yeare: whereby is concluded, that the ancient Authors erred, not only in affirming this Zone to be vnhabitable, by reaſon of the great heat thereof, but in like manner erred, in affirming the Zone that is betweene the circle Artike, and the Pole Artike, to bee alſo vnhabited by reaſon of great cold. The contrary whereof, wee may well affirme, knowing as we know that Iland, with part of Gothland, Norway, Ruſſia, euen to the Latitude of 71. degrees North, and diuers other Lands are inhabited and well peopled. For the better explanation whereof, behold this following portraiture, which plainly diſtinguiſheth euery one of the ſaid fiue Zones in his particular place. The reſt are inſerted in a Table at the end of the next Chapter.



And more it is now experimentally ſound, that though not for ſenſible yet for vitall Creatures, as Beares, Foxes, &c. it is diſcouered to eighty two degrees and vpwards, euident by the notable and profitable diſcouerie of Greenland, Anno 1611. and ſince continued further, with extraordinarie hopes, which GOD grant may to his glory make a finall period, to the good content of the worthie Aduenturers, which for neere fortie yeeres haue ſpent money and meanes therein.

CHAP.

Chap. XVII.

Of the Longitude and Latitude, and of the proportion which the leſſer Circles haue to the great Circle.

The Sphere or Globe of the Earth is alſo diuided in breadth and in length. The (breadth which is called latitude) is by degrées of the Meridian: for from the Equinoctiall to eyther of the two Poles, is 90. degrées. The length (which is called Longitude) is by the degrées of the Equinoctiall, which is diuided in 360. degrées. The firſt degrée of Longitude doth begin at a certaine Meridian, which paſſeth by the Ilands of the Azores, called the fixed Meridian, and the order of the numbring of the ſaid Longitude, is alwayes toward the Eaſt. By euery degrée of the ſaid Longitude, in the Equinoctiall, may bee vnderſtood a great Circle, (called Meridian) to paſſe, each one of them paſſing and méeting in the Poles of the World, ſo that the ſaid great Circles or Meridians doe diuide euery paralell or leſſe circle, proportionally into 360. degrées: but we muſt not vnderſtand theſe degrées to be equall (that is to ſay) as great in one Circle, as in another: for the greater the Circle is, the greater is the degrée in it: and the greater the paralell is, the neerer it is vnto the Equinoctiall line. Euery degrée of the Equinoctiall containeth in Longitude 60. minutes: ſo likewiſe it is to bée vnderſtood of the degrées of Latitude, which bee deuided each one into 60. minutes of latitude, becauſe ỹ degrées & minutes in the great circles, doe not differ in their bignes the one from the other: but the degrees in the paralels, as they are diſtant from the Equinoctiall, and come nére to eyther of the two Poles, they diminiſh conſequently, ſo that one degrée in the paralell of 7. degrées of Latitude, doth make in quantitie but 59. minutes, and 33. ſeconds of the Equinoctiall circle, and to one degrée in the paralell of 12. degrées of Latitude, goeth but 58. minutes, and 41. ſecends of the Equinoctiall, and to one degrée in the paralell of 16. degrées of Latitude,

there

there goeth 57. minutes, and 41. seconds, and so diminishing till you come to the Poles, so that in the paralell of 60. degrées, one degrée is but halfe a degrée of the Equinoctial, and that you may know how many minutes of the Equinoctiall make a degrée in any paralell, betwixt the said Equinoctiall, and eyther of the Poles, behold this Table following: the first Columne whereof sheweth the degrées of Latitude, from the Equinoctiall toward the Pole, the next two Columnes shewes, the first the minutes, the second the seconds, answerable to a degrée of Longitude in the same Latitude: Againe, the 4. Columne are degrées of Latitude, and the 5. and 6. minutes and seconds answerable to a degrée of Longitude, and so consequently euery 4. Columne degrees of Latitude, and the two next minutes and seconds of a degrée of Longitude in the same paralell.

The Table of minutes, which euerie degree containeth in euery of the paralels.

♑	♑	♑	♑	♑	♑	♑	♑	♑	♑	♑	♑	♑	♑	♑
1	59	59	16	57	41	31	51	26	46	41	41	61	29	55	76	14	31
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30
3	59	55	18	56	54	32	50	19	48	40	29	62	27	14	78	12	28
4	59	51	19	56	44	34	49	45	49	39	22	64	26	18	79	11	27
5	59	46	20	56	23	35	49	16	50	38	34	65	25	21	80	10	25
6	59	40	21	56	11	36	48	32	51	37	46	66	24	24	81	9	23
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21
8	59	25	23	55	17	38	47	14	53	36	7	68	22	26	83	7	19
9	59	16	24	54	49	39	46	28	54	25	16	69	21	30	84	6	15
10	59	5	25	54	23	40	45	58	55	24	25	70	20	31	85	5	14
11	58	54	26	52	56	41	45	17	56	23	33	71	19	22	86	4	11
12	58	41	27	52	28	42	44	25	57	32	41	72	18	32	87	3	8
13	58	28	28	52	59	43	43	53	58	21	48	73	17	33	88	2	5
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	2
15	57	57	30	51	58	45	42	26	60	30	0	75	15	22	90	0	0

CHAP.

Chap. XVIII.

Of the Circuit or Compaſſe of the Earth and Water, according to the opinion of the ancient and latter Authors.

IT may here appeare to be neceſſarie for our purpoſe, to declare what ſpace of the ſuperficies of the Earth, or Water, the ancient Writers did ſuppoſe to anſwere to one degrée of a greater Circle in the Heauen: for in diuers Countries they vſed to count by diuers ſorts or manner of meaſures: as the Latines counted by myles, the Greekes by furlongs, the Spaniards and Frenchmen by Leagues, the Egyptians by Signes or markes, and the Perſians by Saguas. But they all agree, that foure graines of Barly make a finger breadth, foure fingers, a handbreadth, foure hands a foot, fiue foot a Geometricall pace (for two ſimple paces make fiue feet.) Alſo 125. Geometricall paces make a furlong, eight furlongs, one myle, which is a thouſand paces, and three myles one League. In Germanie they make Leagues of more feet, and in ſome places more then in other. In France, they count thirty Leagues to one degrée. The Spaniards count ſixteene Leagues and two Terces, and ſeuenteene and a halfe for a degree of the great Circle: this difference, that one League is bigger then another, may come hereof, that one Barly corne is bigger then another. But to our purpoſe, let vs giue to euery League three thouſand paces, and to euery pace 5. foot, and ſo ſhall euerie League haue 15. thouſand foot. In the Cardes of the Sea, that haue their degrées of 15. Leagues and 2. Terces, wee ſay, that of theſe, the roundneſſe of the Land and the Water containeth ſix thouſand Leagues. And in the Cards that haue ſeuenteene Leagues and a halfe for a degrée: Of theſe wee ſay, that it containeth ſix thouſand and three hundred Spaniſh Leagues: and of Engliſh Leagues the whole circumference is 7200. by which whoſoeuer is deſirous to know the Diameter of the whole bodie of the Earth and Water, know that the neereſt proportion that hath hitherto bin found of a Diameter

meter to his circumference, is as 7. to 22. therefore if you say by the rule of proportion, if 22. giue 7. what shall 7200. giue? the Quotient will be 2290$\frac{10}{11}$ Leagues: for the whole Diameter of the Earth and Water, halfe whereof beeing 1145$\frac{10}{11}$ is the Semidiameter or distance from the superficies of the Earth to the Center thereof.

Chap. XIX.
Of the seuen Climates.

The ancient Authours did also deuide that part of the Superficies of the Earth on the North side of the Equinoctiall, which they supposed to be most habitable, into seuen Climates, wherein they did finde to bée diuers conditions and customes of men, and diuersities of Beasts, and of other naturall things: the which things they perceiued to haue a diuersitie in the Countries, as where the day of the one did increase or differ, aboue the day of the other by halfe an houre, so that the space of the superficies of the Earth, betwéene two paralell lines, wherein the longest day doth increase or differ by halfe an houre, is called a Climate. The place where they suppose the first Climate to beginne, is distant in Latitude from the Equinoctiall by 12. degrées, and 45. minutes, where the longest day is twelue houres, and fortie fiue minutes, and the place where the seuenth Climate doth finish, is in the Latitude of fiftie degrees, and thirtie minutes, where the longest day is 16. houres, and 15. minutes, so that the increase of the longest day in the end of the seuenth Climate, doth exceed it in the beginning of the first Climate by three houres and a halfe, and the whole compasse of the Earth, with all the seuen Climates, doth containe in breadth 37. degrees, and 45. minutes, but their length is supposed to extend to 180. degrees of Longitude. In that manner, a Climate, the nérer it is vnto the Equinoctiall, the more it containeth of the superficies of the Earth, because the paralel Circles, the nérer they be vnto the Equinoctiall,

the

the greater is the compaſſe of the Earth which they make in length: and the leſſer the compaſſe is, the neerer they bee vnto the Poles, as doth appeare euidently by the Meridians where they doe all concurre, and met in the Poles, their diſtances waxing continually leſſer and leſſer, the neerer they be vnto the ſaid Poles, ſo that the nærer the Climate is vnto the Pole, the leſſer it containeth of myles in the length. In like manner ſhall you vnderſtand, that greater is the breath of the firſt clime, then of the ſecond, and the ſecond then the third, and likewiſe of the other. For in how much the more from the Equinoctial you come nére to the Pole, ſo much the more is the Sphere oblique or crooked, and conſequently the day increaſeth more. By reaſon whereof, in leſſe ſpace is found the increaſing of halfe an houre, in which the Climate maketh difference, and doth vary. Which thing ſhall be more manifeſt to him that beholdeth the Latitude of them all, as may appeare by the Table here following: In which you may ſée the houres, which the greateſt day containeth of euery Climate in his beginning, middeſt and end, with alſo the eleuation of the Pole, or diſtance from the Equinoctial, and alſo the degrées of latitude, which euery Climate containeth.

	The longeſt day.			The eleuation of the Pole.			Differences.		
Climate.	Begin.		Midſt.	End.	Beginning.		Midſt.	End.	of the Latitude.	
	ho	M.	ho	M.	ho	M.	G.	M.	G.	M.	G.	M.	G.	M.
1	12	45	13	0	13	15	12	45	16	40	20	20	7	45
2	13	15	13	30	13	45	20	30	24	15	27	30	7	0
3	13	45	14	0	14	15	27	30	30	45	33	40	6	10
4	14	15	14	30	14	45	33	40	36	24	39	0	5	20
5	14	45	15	0	15	15	39	0	41	20	43	30	4	30
6	15	15	15	30	15	45	43	30	45	24	47	15	3	45
7	15	45	16	0	16	15	47	17	48	40	50	30	3	15
8	16	15	16	30	16	45	50	30	51	58	53	17	2	47
9	16	45	17	0	17	15	53	17	54	29	55	24	2	17

The

The first Climate is called Dia Meroes, Meroe is a Citie of Affricke, vnder the burnt Zone, on this side the Equinoctiall, 16. degrées.

The second is called Dia Siena: Siena is a Citie in the confines of Ethiope, where there is a Well that sheweth the Summer Solsticiall, because that place is vnder the Circle of the Tropicke of Cancer, and the Sun séemeth to stand directly ouer that place at midday of the Solsticiall, whereby the Well is then very cleere, and hath in it no shadow at all, as the Poet Lucan maketh mẽtion in Farsalia, where he saith;

Vmbras nusquam flectentes.

That is to say, Shadowes no where reflecting.

The third is Dia Alexandros: Alexandria is a famous Citie in Affricke, builded by great Alexander, and is the chiefe Citie or Metropolis of Egypt.

The 4. is Dia Rhodos: Rhodes is an Iland of Asia the lesse, where were sometimes the Knights of the Rhodes, called the Knights of the order of Saint Iohn, or Knights of Ierusalem, who were driuen from thence, when the Iland and Citie was taken by Sultan Soliman, the great Turke in the yére 1522. Philip Vrlerio Frenchman, being then Grandmaster of the Rhodes. Within this fourth Climate is the Citie of Ierusalem, within the Holy Land called Palestina, and also a great part of Spaine, with many other Prouinces.

The fift, is Dia Romes, Rome is the most famous Citie of Italy, and most notorious of al Europe, sometimes the head of the World, Dominatrix of Nations, and now the Sée of the Bishop of Rome.

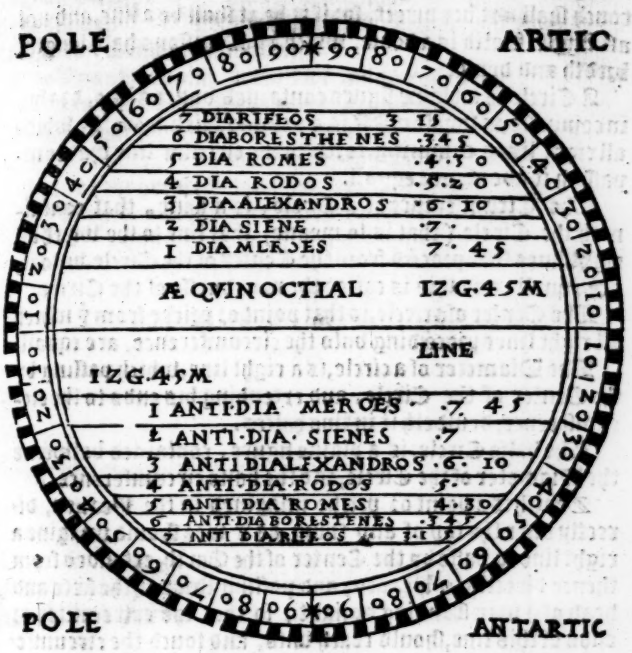
The sixt is, Dia Boristhenes: Boristhenes is a great Riuer of Scythia, the fourth arme of the Riuer Istro. It falleth into the Sea Euxinum: and whereas all other Riuers of Scythia are troubled, this is cléere and faire, also wholesome to bee drunke and full of Fishes.

The seuenth Climate, is called Dia Riseos. The Mountaines called Risei, are famous in the part of Europe, called Parmatia, and are continually couered with Snow. Out of

these, springeth the Riuer Tanais, well knowne in the world by fame. When it is written with ph. it is the name of certaine Mountaines of Arcadia. And here ought wee not to be ignorant, that whereas the Authours assigned onely seuen Climates, they might haue made many more: And for that they iudged the part of the Pole Antartick not to be inhabited, they assigned no Climates thereto.

To these seuen Climates, the later Cosmographers haue added two more, which they call the eight and the ninth, beginning where the seuenth Climate ends, and continuing to fiftie fiue degrées, 34'. of Latitude, the eighth Clime passing through Meotis, and the ninth through Denmarke. Both which Climates are hereunto added with the length of the longest day, and the elenation of the Pole, both at the beginning, middest and end of the said Climes. In like manner describing Meridionall or South Climates, we call them by the selfe same names, as we did the foresaid Septentrionall or North Climates, sauing that it is necessary to put before euery of them this Greeke preposition Anti, which in the Latine Tongue signifieth Contra or Contrarium (that is) contrary or against. So that as we named the first North Climate, Dia Meroes, we must to the first of the South adde this word Anti, and so shall the first South Climate be named Anti Dia Meroes: The second, Anti Dia Sienes, and so forth of the other, as is seene in the Figure here following.

CHAP.



CHAP. XX.

Of certaine Principles that ought to be knowne for this Science.

IN treating of the Sphere, we haue spoken of Circles, Circumferences, Centers, Diameters, Lines, with such other words appropriate to this Science, the which what they are, it is conuenient further to declare.

A right Line, is a short Extention from Point to Point.

An Angle, is the touching of lines in one superficies, whose

touch shall not bee direct, for if it be, it shall be a line, and not an Angle. Solid is a bodie, which by Diuisions hath length, bredth and depth.

A Circle is a plaine figure contained vnder a line, drawn in compasse, in whose midst is a point or prick, from the which all right lines comming forth to the circular line that compasseth it about, are equall.

The Circumference of a Circle, is a Line, that containeth the Circle (that is to meane) that line to the which all right lines that proceed from the Center of the Circle, vnto it, are equall: and this is called the roundnesse of the Circle.

The Center of a circle, is that point or pricke from ỳ which all right lines proceeding vnto the circumference, are equall.

The Diameter of a circle, is a right line, which passing by the Center of the Circle, and extending his ends to the circumference, deuideth it in two halfes.

The halfe Circle, is a plaine figure, contained betweene the Diameter of the Circle, and the halfe circumference.

Zenith is a point or pricke imagined in the Heauen, directly ouer the top of any thing, as if wee should imagine a right line to passe by the Center of the Earth, extended from thence directly to Heauen, and passing through the féete and head of a man standing vpright, so that the extremities or ends of this line, should reach vnto, and touch the circumference of heauen: then the imagined point or prick of heauen, where the end of the line toucheth, is called Zenith, or point of the head, or verticall point: the same is to be vnderstood of a Citie or any other thing, when we speak of ỳ Zenith therof.

Eccentricke is a Circle, which hath his Center distant or diuided from the Center of the world, and is described in the Heauen of the Sun, imagining a Line from the Center of the Eccentricke, to the Center of the Sunne, making a complete reuolution at the proper motion of the Sunne, in the other Heauens, imagining a line from the Center of his Eccentricke, to the Center of his Epicicle, and being moued a whole reuolution at the proper motion of the Epicicle.

The

The Epicicle is a Circle or little rundell set in the depth of the Eccentricke: in which the Planet fixed, and nére to his Center, is moued circularly.

The Auge is a point in the circumference of the Eccentricke, neerest vnto the Firmament, or it may be said, that the Auge is a point farthest distant from the Earth: Aux in the Gréeke Tongue is as much to say, as the greatest Longitude or the greatest elevation from the Earth. The Oppolite of Auge, is another point in the circumference of the Eccentricke, nérest vnto the Earth, and farthest distant from the Firmament.

Here endeth the first part.

THE SECOND PART, ENTREATING OF THE MOTIONS OF THE Sunne and the Moone, and the Effects cauſed *thereby.*

CHAP. I.

Of the Courſe of the Sunne in the Zodiacke, and the Effects cauſed by the ſame.

WE haue briefly ſpoken of the Sunne and of the other Heauens: But for as much as the Sun muſt be our marke, guide, and gouernour in Nauigation, whereof we intend to giue perfect inſtructions, it ſhall be neceſſarie eſpecially and preciſely to declare the courſe and motions thereof. Therefore (as wee haue ſaid) the Sunne is moued vnder the Zodiacke, and vpon his Poles in the line Ecliptike, paſſing by the 12. Signes, beginning in the firſt degree

degree of Aries, where he maketh Equinox, that is to say, hee maketh the day equal vnto the night in al places. Then from Aries he entreth and mouеth into Taurus, approching nearer and nearer vnto vs on the North part, whereby the length of the dayes are increased with vs, and the nights are shortned. Then entreth he into Gemini, and from Gemini, into Cancer, where in the beginning of the first degrée, hee maketh Solstice, and toucheth the Summer or Estiuall Tropicke, and then are the dayes longest with vs, and the nights shortest. Then declineth he no farther from the Equinoctiall, but returning toward it, passeth by this Signe, shortning the dayes to vs, and lengthning the nights. From this Signe of Cancer, it entreth into Leo, and passeth by it into Virgo, and by it entreth into the first degrée of Libra, where hee is in the Equinoctiall, and then he maketh the other Equinox, so that the night is then equal vnto the day ouer all the World: And passing by this Signe, goeth declining from the Equinoctiall toward the Pole Antartike, increasing the nights to vs, and shortning the dayes, and so entreth into Scorpio, and from thence into Sagitarius: And passing by it, entreth into the first degrée of Capricorn, to the Hiemall or Winter Tropicke, and then are the longest nights vnto vs, and the shortest dayes. From hence he returneth toward the Equinoctial, shortning vnto vs the nights, and lengthing the dayes. He passeth by this Signe of Capricorne, and entreth into Aquarius, and passing by it, entreth into Pisces, and passing from thence, returneth to his first point of the Equinoctiall of Aries where he began. Hereby it followeth, that as the Sunne goeth the halfe of the Zodiacke on this part of the Equinoctiall, and the other halfe, on the other part of it, and in these halfes hath diuers declinations, is caused the increasing or decreasing of ỳ dayes and nights, to one more, and to another lesse, according as euery one with his Horizon discouereth of the course of the Sunne, by the little or much that he is departed or distant from the Equinoctiall, or as the Pole is raysed aboue his Horizon: so that when as to them that are on this part of the Equinoctiall, is

the longeſt day, and the ſhorteſt night: euen ſo to them on the other part, is the longeſt night and ſhorteſt day. And contrariwiſe, when vnto vs is the ſhorteſt day, vnto them is the longeſt, which ſhall further appeare by euident demonſtration in the laſt Chapter of the third part.

The diſcréet Reader ſhall here note, that the Sunne is not moued regularly in the Zodiacke, making ſo much by his proper motion in one day, as in the other, becauſe his regular motion is in reſpect of the Center of his owne proper Sphere or Orbe, wherein he is moued, whoſe Center is diſtant without the Center of the World, toward that part of Cancer, ſo that the greater part of his Orbe Eccentricke, is toward the Septentrionall part, where the Sunne paſſing by the Septentrionall Signes, is more diſtant from the Earth, and hath more to goe of his Orbe Eccentricke, then being in the South Signes: for paſſing by the North Signes, he tarrieth nine dayes more, to deſcribe that halfe of the Zodiacke, then the other halfe toward the South part, and for that cauſe the Sun is more ſwifter in his motion in the Zodiack one time then another, for his motion in one day in the South Signes, ſhall bee greater then it is in one day in the North Signes, as ſhall appeare in the Table that followeth, whoſe vſe is, for the finding of the motion, and true place of the Sunne in the Zodiacke for euery day of the yéere. And hereby it followeth of the ſaid vnequall mouing of the Sun, and by the obliquitie of the Zodiack, certaine dayes of Winter, with their nights, are longer then certain other of Summer, with their nights, that is to ſay, that the day naturall in the Winter, doth ſurmount that in the Summer, becauſe the right aſcenſion, which anſwereth to one dayes motion of the Sun, being in the South Signes, is greater then the aſcenſion for one dayes mouing being in the North Signes.

Of this inequalitie of dayes and nights throughout the World, it is moſt euident to thoſe that trauaile in far Countries: for we ſée plainly, that vnder the Equinoctiall, the dayes and nights are of an equall length at all times, but departing from the ſaid Equinoctiall towards eyther of the

Poles,

Poles, the dayes are longer in Summer then in Winter, and the nights longer in Winter then in Summer: so likewise the further from the Equinoctiall, the greater is the inequalitie, notwithstanding, so as the length of the night in Winter doth counteruaile the length of the day in Summer: for we see by experience, that vnder the Equinoctiall, the dayes and nights are alwayes twelue houres apéce, vnder the Tropicke the longest day is thirteene houres and $\frac{1}{2}$ in Summer, and the longest night thirteene houres and $\frac{1}{2}$ in Winter. In the South part of Spaine the longest day in Summer fourteene houres and $\frac{1}{2}$, and the longest night in Winter as much. Here in the South part of England the longest day in Summer, fifteene houres and somewhat more, and the longest night in Winter as much, and so consequently, the further from the Equinoctiall, the inequalitie of the dayes and nights increasing more swifter, insomuch that far North or South they cānot count the length of their daies by houres and minutes, but first by dayes and houres, then by weekes, and next by moneths and weeks: & lastly, onely by moneths: for certaine it is, that vnder eyther of the Poles the day and night are againe equall, consisting of one day and one night, and the yéere consisting of fiue moneths, which is all the time that the Sun is in those Signes, which are on the same side of the Equinoctiall, & the night being likewise other fiue months, the Sun then occupying the contrary Signes: and to the end that without great labour or calculation you may know the length of the day in euery seuerall Latitude, I haue here annexed a Table of the longest day in each seuerall Latitude.

CHAP.

Latitude. Degrees of	Length of the Day. H.	M.	Degrees of	Length of the Day. H.	M.
0	12	0	47	15	42
3	12	10	48	15	51
6	12	20	49	16	0
9	12	32	50	16	10
12	12	42	51	16	20
15	12	53	52	16	30
18	13	5	53	16	42
21	13	17	54	16	54
24	13	30	55	17	7
27	13	42	56	17	21
30	13	56	57	17	36
32	14	6	58	17	52
34	14	16	59	18	11
36	14	27	60	18	31
38	14	28	61	18	52
40	14	51	62	19	18
42	15	4	63	19	48
44	15	19	64	20	24
45	15	26	65	21	1
46	15	24	66	22	20

Lat.	Length of the Day. Moneths	Weekes	Daies	Houres.
67	0	3	3	2
68	1	2	0	1
69	1	3	5	16
70	2	3	1	14
71	2	2	4	0
72	2	3	5	7
73	3	0	5	5
74	3	1	5	17
75	3	2	6	1
76	3	3	5	7
77	4	0	4	14
78	4	1	3	17
79	4	2	1	10
80	4	3	1	5
81	4	3	5	14
82	5	0	5	7
83	5	1	4	2
84	5	2	2	2
85	5	3	0	5
86	5	3	5	11
87	6	0	3	21
88	6	1	1	5
89	6	1	6	22
90	6	2	0	14

Chap. II.

Sheweth the true place of the Sunne in the Zodiacke.

The true place of the Sunne is a point or pricke in the Zodiacke, which is thus found, viz. by drawing a right line

line from the Center of the World, to the Center of the Sun, and carrying the same right forth vnto the Zodiacke, the extreme point, or vtmost extention of which Line is the true place of the Sunne, which is so also to bee vnderstood of the Mone and the other Planets, which said place of the Sun, is to be found diuers seuerall wayes, chiefly by the Ephemerides, as also by the Globe, and other Instruments, of which that described in the seuenth Chapter here following, is very plaine and easie, both for the ease of such as haue not an Ephemerides, and yet desire more exactnesse then by Instruments can be performed: this Table of the Suns true place, with the Table of Equation thereto annexed, will verie truly satisfie their expectations, which first Table of the true place of the Sun is, truly calculated for this present yeere 1609. to find which true place in any day thereof: looke in the head of the said Table for the Moneth, and in the first Columne at the left hand for the Day of the said Moneth: and in the common Angle against the Day and vnder the Moneth, shall you find the number in degrees and minutes, with the Signe ouer head, that the Sunne possesseth the Day and Moneth desired in the yeere aforesaid.

A Table.

A Table of the true place of the Sunne.

Dayes.	January		February		March.		April.		May.		Iune.	
	Captic.		Aquar.		Pisces.		Aries.		Taurus.		Gemini.	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	22	26	22	54	20	59	21	33	20	39	20	21
2	23	27	23	55	21	59	22	32	21	37	21	18
3	23	28	24	56	22	58	23	30	22	35	22	16
4	24	29	25	56	23	58	24	29	23	33	23	13
5	25	30	26	57	24	57	25	28	24	30	24	10
6	26	31	27	57	25	57	26	26	25	28	25	7
7	27	32	28	58	26	57	27	24	26	26	26	4
8	28	33	29	58	27	56	28	23	27	23	27	2
9	29	35	0 ♓	58	28	55	29	21	28	21	27	59
10	0 ♒	36	1	59	29	55	0 ♉	19	29	18	28	56
11	1	37	2	59	0 ♈	54	1	18	0 ♊	16	29	53
12	2	38	3	59	1	53	2	16	1	13	0 ♋	50
13	3	39	4	59	2	53	4	14	1	11	1	48
14	4	40	6	0	3	52	4	13	3	9	2	45
15	5	41	7	0	4	51	5	11	4	6	3	42
16	6	42	8	0	5	50	6	9	5	4	4	39
17	7	43	9	0	6	49	7	7	6	1	5	36
18	8	44	10	0	7	49	8	5	6	59	6	34
19	9	45	11	0	8	48	9	3	7	56	7	31
20	10	45	12	0	9	47	10	1	8	53	8	38
21	11	46	13	0	10	46	10	59	9	51	9	25
22	12	47	14	0	11	45	11	57	10	48	10	22
23	13	48	15	0	12	44	12	56	11	45	11	19
24	14	49	16	0	13	43	13	54	12	43	12	17
25	15	50	17	0	14	42	14	51	13	40	13	14
26	16	51	18	0	15	41	15	49	14	37	14	11
27	17	51	18	59	16	39	16	47	15	35	15	8
28	18	52	19	59	17	38	17	45	16	32	16	5
29	19	53			18	37	18	43	17	29	17	3
30	20	54			19	36	19	41	18	26	28	0
31	21	55			20	35			19	24		

A Table of the true place of the Sunne.

	July.		August.		Septem.		Octob.		Nouem.		Decemb.	
Dayes	Cancer.		Leo.		Virgo.		Libra.		Scorpio.		Sagitar.	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	18	57	18	36	18	36	18	6	19	7	19	33
2	19	54	19	34	19	37	19	6	20	7	20	34
3	20	51	20	31	20	33	20	5	21	8	21	35
4	21	49	21	29	21	32	21	5	22	8	22	37
5	22	46	22	27	22	30	22	5	23	9	23	38
6	23	43	23	25	23	29	23	4	24	10	24	39
7	24	40	24	23	24	28	24	4	25	10	25	40
8	25	38	25	20	25	26	25	4	26	11	26	41
9	26	35	26	18	26	25	26	4	27	12	27	43
10	27	32	27	16	27	24	27	3	28	12	28	44
11	28	30	28	14	28	23	28	3	29	13	29	45
12	29	27	29	12	29	22	29	3	0 ♐	14	0 ♑	46
13	0 ♌	24	0 ♍	10	0 ♎	21	0 ♏	3	1	15	1	47
14	1	22	1	8	1	19	1	3	2	16	2	49
15	2	19	2	6	2	18	2	3	3	17	3	50
16	3	16	3	4	3	17	3	3	4	17	4	51
17	4	14	4	2	4	16	4	3	5	18	5	52
18	5	11	5	0	5	15	5	3	6	19	6	54
19	6	8	5	58	6	14	6	4	7	20	7	55
20	7	6	6	56	7	13	7	4	8	21	8	56
21	8	2	7	54	8	13	8	4	9	22	9	57
22	9	1	8	52	9	12	9	4	10	23	10	58
23	9	58	9	51	10	11	10	4	11	24	11	59
24	10	56	10	49	11	10	11	5	12	25	13	1
25	11	53	11	47	12	10	12	5	13	26	14	2
26	12	51	12	45	13	9	13	5	14	27	15	4
27	13	48	13	44	14	8	14	5	15	29	16	5
28	14	46	14	42	15	8	15	6	16	30	17	6
29	15	43	15	41	16	7	16	6	17	31	18	7
30	16	41	16	42	17	7	17	7	18	32	19	8
31	17	39	17	40			18	7			20	10

A Table of the Equation of the Sunne.

Yeeres of our Lord.	Equation to be aded	Yeeres of our Lord.	Equation to be aded	Yeeres of our Lord.	Equation to be aded
	M		M		M
1609	0 0	1631	34	1651	37
1610	45	1632	19	1652	2
1611	30	1633	0 5	1653	0 8
1612	15	1634	50	1654	53
1613	0 1	1635	35	1655	38
1614	46	1636	20	1656	23
1615	31	1637	0 5	1657	0 9
1616	16	1638	50	1658	54
1617	0 2	1639	35	1659	39
1618	47	1640	20	1660	24
1619	32	1641	0 6	1661	0 10
1620	17	1642	51	1662	55
1621	0 3	1643	36	1663	40
1622	48	1644	21	1664	25
1623	33	1645	0 7	1665	0 11
1624	18	1646	52	1666	56
1625	0 4	1647	37	1667	41
1626	48	1648	22	1668	26
1627	33	1649	0 8	1669	0 12
1628	18	1650	52	1670	57
1629	0 4				
1630	49				

But if you desire the true place of the Sunne for any other yéere afterward, séeke in this Table of the Equation of the Sunne, for the yéere in which you desire the true place thereof; against which yéere so found, you shall sée in the next Columne certaine minutes, these minutes adde vnto the degrées and minutes found against the day of your moneth in the former Table of the Sunnes true place, and from the totall take one whole degrée, except onely in those yéeres against

gainſt which before the minutes is ſet a Cipher, and then are you onely to adde the minutes without making any Subſtraction.

Chap. III.

Of the declination of the Sunne.

The declination of the Sun is the Arch of the greater circle, which paſſeth by the Poles of the World, included betweene the Equinoctiall and the Zodiacke. And here is to be noted, that whatſoeuer foure points or prickes which are equally diſtant from the points of the Equinoxes (which are the beginning of Aries & Libra) ſhal haue equal declinations.

Whereof it followeth, that the foure quarters of the Zodiacke haue equall Declinations. And to auoide prolixitie, I will adde hereunto a Table of the Declinations of onely one quarter of the Zodiack, ſo that all hauing one ſelfe ſame manner of Declinations, it may ſerue for all, and the order of it is this. The Signes whoſe declination increaſeth, are in the head or front of the Table, & the degrees of theſe Signes deſcend by the left ſide thereof. And the Signes whoſe Declination decreaſeth, are in the foot of the Table, and the degrees of theſe Signes riſe by the right ſide of the ſame. The diſpoſition of the Table being vnderſtood, then to know what Declination the Sun hath in euery degree of the Zodiacke, you ought to know the true place of the Sunne (as in the Chapter paſt is declared) for the day of the declination which you deſire to know, and the Signe which the Sun ſhal bee found in that day, ſhall you ſeeke in the front or foot of the Table. And if it be in the front, you ſhall ſeeke the number of the degrees on the left ſide. And if it ſhall be at the foote of the Table, you ſhall ſeeke it on the right ſide. Then aboue or vnder the Signe in the front of that degree of the ſaid Signe, you ſhall find 2. numbers, whereof the firſt is of degrees, & the ſe-

cond

Sig.	♈	♌	♉	♍	♊	♐	Signes
°	°	♑	°	♑	°	♑	°
0	0		11	30	20	12	30
1	0	24	11	51	20	25	29
2	0	48	12	12	20	37	28
3	1	12	12	33	20	49	27
4	1	36	12	53	21	0	26
5	2	0	13	13	21	11	25
6	2	23	13	33	21	22	24
7	2	47	13	53	21	32	23
8	3	11	14	13	21	42	22
9	3	35	14	32	21	51	21
10	3	58	14	51	22	0	20
11	4	22	15	10	22	9	19
12	4	45	15	28	22	17	18
13	5	9	15	46	22	25	17
14	5	32	16	5	22	32	16
15	5	55	16	23	22	39	15
16	6	19	16	40	22	46	14
17	6	42	16	57	22	22	13
18	7	5	17	14	23	57	12
19	7	28	17	31	23	3	11
20	7	50	17	47	23	8	10
21	8	13	18	3	23	12	9
22	8	35	18	19	23	15	8
23	8	58	18	34	23	19	7
24	9	20	18	49	23	22	6
25	9	42	19	4	23	24	5
26	10	4	19	18	23	26	4
27	10	26	19	32	23	28	3
28	10	47	19	46	23	29	2
29	11	9	19	59	23	30	1
30	11	30	20	12	23	30	0
Sig.	♓	♍	♒	♌	♏	♑	Signes

cond of minutes, and those degrees and minutes of declination, the Sun hath that day: suppose the place of the Sun, where the 24. degree of ♈. the name of the Signe standeth at the toppe of the Table: therefore I seeke out the 24. degree, on the left hand, and going from thence towardes the right hand, till I come right against ♈. I find the declination to be nine degrees. 20'.

Againe, suppose the place of the Sun to be 20. degrees of ♌. the name of the Signe is at the foote of the Table, therefore I seeke out the 20. degree on the right hand, and going from thence towards the left hand, till I come right against ♌. I find the declination to bee 14. degrees, 51'.

And this is vnderstood without hauing respect to the odde minutes aboue the degree which the true place of the Sun hath.

But if you desire to derife this more precisely, note the declination of that degree, and of the degree following, and take the lesse from the more, and that which remaineth, shall bee the differences of the declination from the one degree to the other, of which

which difference ye shall take a part proportionally, as are the minutes of the place of the Sun vnto 60. And this part of minutes must be added to the first declination of it, if the declination increase, or must be taken from it, if it decrease, and then that riseth thereof, shall be the precise Declination for that Signe, degree and minute.

As for example, the 6. of Iuly, 1609. I find the place of the Sunne to bee in 23. degrées, 43. of ♋. and to 23. degrées answeres 21. degrées, 32′. of Declination, and the Declination of 24. degrees, is 21. degrees, 22′. the difference is 1′0. then I say by the rule of 3. if 60. which is one degrée, giue 10′. which is the difference of one degrées Declination, what giueth 43′. which are the odde minutes of the place of the Sun, and the quotient shewes 7′. which because the Declination decreaseth, I substract from 21. degrées, 32. the Declination of 23. degrées iust, and there resteth 21. degrées, 25′. for the Declination of the Sun, being in 23. degrees, 43. of ♋.

Againe this present yeere 1609. the 8. of Nouember the Sun is in 26. degrées, 1′1. of ♏, and to 26. degrees of ♏. answeres 19. degrees, 18. of Declination, and to 27. degrees answere, 19. degrees, 32. of declination, the difference is 14. then I say, if 60. giue 14. what giues 11? the quotient is 2. which because the Declination doth increase, I adde to 19. degrees, 18. it makes 19. degrees, 20. which is the Declination of the day proposed.

This would suffice to those that would take the paine to calculate, but for that it is somewhat tedious, especially for Sea-men to stand about to calculate at all times, when they shall haue occasion to vse the Sunnes Declination, I haue here set downe a particular Table of the Suns Declination for euery day of the moneth, for foure seuerall yeeres, according to the true place of the Sun formerly set downe.

Chap. IIII.

Sheweth the Declination of the Sun for euery Moneth and day of the Moneth throughout the yeere.

KNowing the great vſe, neceſſitie, and benefit which doth abound to all Sea-faring men, by hauing knowledge what Declination the Sunne makes, from the two Equinoctiall points, viz. ♈ and ♎ towardes eyther of the Poles, that is to ſay, North or South, as alſo conſidering that the Table to the ſame purpoſe ſet downe before in the third Chapter of the ſecond part (becauſe it is calculated, but onely for the degrées of each Signe of the Zodiacke) is ſomewhat troubleſome to finde, becauſe the true place of the Sunne is required, and then to worke by the Rule of Proportion, which euery one cannot doe, or at the leaſt wiſe cannot at all times haue ſo much leiſure, therefore I ſay, for the more eaſie and readie finding of the foreſaid Declination I haue here gathered a Regiment or Table, according to the beſt and trueſt Calculaters, who in theſe dayes finde the greateſt Extention or Declination of the Sun, to bee from the Equinoctiall towards eyther of the Poles 23. degrés, 28. minutes, which greateſt Declination or diſtance, are called the Tropicall points of ♋ and ♑, vnto which points, the Sun by his continuall moning in the Zodiacke hauing attained, returneth againe to the Equinoctiall, deſcending by the ſame proportion of time, as hee aſcended, and ſo from thence to the contrarie Tropicke, thereby making the beginnings of the foure principall times or quarters of the yeere, that is to ſay, Winter, the Spring, Summer and Autumne, or Harueſt: the chiefe vſe of which Tables are to find the Eleuation or height of the Poles aboue the Horizon, in any place whatſoeuer, being calculated for foure yéres, viz. the Leape yeere, and the firſt, ſecond and third, after the Leape yeere, beginning at the yeere 1613. being the firſt after the Leape yeere, and may ſerue at the leaſt for 20. yéres without any notable errour.

The vſe and working whereof followeth after the ſaid Tables.

Ianuarie.

First.				Second.				Third.				Leap yeere		
1613				1614				1615				1616		
1617				1618				1619				1620		
1621				1622				1623				1624		
1625				1626				1627				1628		
1629				1630				1631				1632		
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.
1	21	48		1	21	49		1	21	52		1	21	54
2	21	38		2	21	40		2	21	43		2	21	45
3	21	28		3	21	30		3	21	33		3	21	35
4	21	17		4	21	20		4	21	23		4	21	25
5	21	6		5	21	8		5	21	12		5	21	15
6	20	51		6	20	57		6	21	0		6	21	4
7	20	43		7	20	46		7	20	49		7	20	52
8	20	31		8	20	34		8	20	37		8	20	40
9	20	18		9	20	21		9	20	24		9	20	28
10	20	5	South Declination.	10	20	8	South Declination.	10	20	11	South Declination.	10	20	15
11	19	51		11	19	54		11	19	58		11	20	1
12	19	38		12	19	41		12	19	45		12	19	48
13	19	23		13	19	27		13	19	30		13	19	34
14	19	9		14	19	12		14	19	16		14	19	20
15	18	54		15	18	58		15	19	2		15	19	5
16	18	39		16	18	42		16	18	46		16	18	51
17	18	23		17	18	27		17	18	31		17	18	35
18	18	8		18	18	12		18	18	16		18	18	20
19	17	51		19	17	56		19	17	59		19	18	4
20	17	35		20	17	38		20	17	43		20	17	47
21	17	19		21	17	23		21	17	27		21	17	31
22	17	1		22	17	6		22	17	10		22	17	14
23	16	44		23	16	48		23	16	52		23	16	57
24	16	26		24	16	31		24	16	35		24	16	39
25	16	9		25	16	13		25	16	18		25	16	22
26	15	50		26	15	55		26	15	59		26	16	4
27	15	31		27	15	36		27	15	41		27	15	45
28	15	12		28	15	17		28	15	22		28	15	26
29	14	54		29	14	59		29	15	4		29	15	8
30	14	34		30	14	40		30	14	44		30	14	49
31	14	15		31	14	20		31	14	25		31	14	30

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First.	Second.	Third.	Leapyeere.
1613	1614	1615	1616
1617	1618	1619	1620
1621	1622	1623	1624
1625	1626	1627	1628
1629	1630	1631	1632

South Declination.

D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	13	55	1	14	0	1	14	6	1	14	10
2	13	35	2	13	40	2	13	45	2	13	50
3	13	14	3	13	20	3	13	25	3	13	30
4	12	54	4	13	0	4	13	4	4	13	10
5	12	34	5	12	40	5	12	44	5	12	50
6	12	13	6	12	20	6	12	24	6	12	29
7	11	52	7	11	58	7	12	3	7	12	8
8	11	31	8	11	36	8	11	42	8	11	47
9	11	10	9	11	15	9	11	21	9	11	26
10	10	48	10	10	53	10	11	0	10	11	5
11	10	26	11	10	31	11	10	38	11	10	43
12	10	4	12	10	10	12	10	16	12	10	21
13	9	42	13	9	48	13	9	54	13	9	59
14	9	20	14	9	26	14	9	32	14	9	37
15	8	58	15	9	4	15	9	10	15	9	15
16	8	30	16	8	41	16	8	48	16	8	53
17	8	13	17	8	18	17	8	24	17	8	30
18	7	50	18	7	56	18	8	2	18	8	7
19	7	28	19	7	33	19	7	39	19	7	44
20	7	5	20	7	11	20	7	17	20	7	22
21	6	42	21	6	48	21	6	54	21	6	59
22	6	19	22	6	25	22	6	31	22	6	36
23	5	55	23	6	2	23	6	8	23	6	13
24	5	32	24	5	38	24	5	44	24	5	49
25	5	9	25	5	15	25	5	21	25	5	26
26	4	45	26	4	52	26	4	58	26	5	3
27	4	22	27	4	28	27	4	34	27	4	39
28	3	58	28	4	5	28	4	11	28	4	16
									29	3	52

First. 1613 1617 1621 1625 1629		Second. 1614 1618 1622 1626 1630		Third. 1615 1619 1623 1627 1631		Leap yeere. 1616 1620 1624 1628 1632	
D.	G. M.	D.	G. M.	D.	G. M.	D.	G. M.
1	3 35	1	3 41	1	3 47	1	3 30
2	3 11	2	3 18	2	3 24	2	3 6
3	2 47	3	2 54	3	3 0	3	2 42
4	2 23	4	2 30	4	2 36	4	2 18
5	2 0	5	2 6	5	2 12	5	1 55
6	1 36	6	1 43	6	1 49	6	1 30
7	1 13	7	1 18	7	1 25	7	1 7
8	0 50	8	0 56	8	1 1	8	0 43
9	0 26	9	0 32	9	0 38	9	0 21
10	0 2	10	0 8	10	0 14	10	0 4
11	0 22	12	0 16	11	0 10	11	0 28
12	0 45	12	0 39	12	0 34	12	0 52
13	1 9	13	1 3	13	0 57	13	1 15
14	1 32	14	1 27	14	1 21	14	1 38
15	1 57	15	1 50	15	1 44	15	2 2
16	2 19	16	2 13	16	2 8	16	2 25
17	2 42	17	2 36	17	2 31	17	2 49
18	3 6	18	3 0	18	2 54	18	3 13
19	3 30	19	3 24	19	3 18	19	3 36
20	3 53	20	3 48	20	3 42	20	3 59
21	4 16	21	4 10	21	4 4	21	4 22
22	4 39	22	4 33	22	4 28	22	4 45
23	5 2	23	4 56	23	4 50	23	5 9
24	5 26	24	5 19	24	5 14	24	5 32
25	5 48	25	5 42	25	5 37	25	5 54
26	6 11	26	6 5	26	5 59	26	6 17
27	6 34	27	6 28	27	6 23	27	6 40
28	6 57	28	6 50	28	6 45	28	7 3
29	7 19	29	7 13	29	7 8	29	7 27
30	7 42	30	7 36	30	7 30	30	7 47
31	8 3	31	7 57	31	7 51	31	8 9

South Declination. Equi- North Declination.

South Declination. noctii- North Declination.

North Declination. all. South Declination.

First.				Second.				Third.				Leap yeere			
1613				1614				1615				1616			
1617				1618				1619				1620			
1621				1622				1623				1624			
1625				1626				1627				1628			
1629				1630				1631				1632			
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.	
1	8	25	North Declination.	1	8	19	North Declination.	1	8	14	North Declination.	1	8	31	
2	8	47		2	8	41		2	8	35		2	8	53	
3	9	9		3	9	3		3	8	58		3	9	15	
4	9	31		4	9	25		4	9	20		4	9	36	
5	9	52		5	9	46		5	9	42		5	9	58	
6	10	14		6	10	8		6	10	3		6	10	19	
7	10	35		7	10	30		7	10	24		7	10	40	
8	10	55		8	10	50		8	10	45		8	11	1	
9	11	16		9	11	11		9	11	6		9	11	22	
10	11	37		10	11	32		10	11	27		10	11	43	
11	11	57		11	11	52		11	11	47		11	12	3	
12	12	18		12	12	12		12	12	7		12	12	23	
13	12	38		13	12	33		13	12	28		13	12	43	
14	12	57		14	12	53		14	12	47		14	13	2	
15	13	17		15	13	12		15	13	7		15	13	21	
16	13	36		16	13	32		16	13	26		16	13	41	
17	13	55		17	13	50		17	13	46		17	14	0	
18	14	15		18	14	10		18	14	5		18	14	19	
19	14	33		19	14	29		19	14	23		19	14	37	
20	14	51		20	14	46		20	14	42		20	14	56	
21	15	10		21	15	5		21	15	0		21	15	14	
22	15	27		22	15	23		22	15	19		22	15	32	
23	15	46		23	15	41		23	15	36		23	15	50	
24	16	3		24	15	59		24	15	54		24	16	7	
25	16	20		25	16	16		25	16	11		25	16	25	
26	16	37		26	16	33		26	16	28		26	16	41	
27	16	53		27	16	49		27	16	45		27	16	57	
28	17	10		28	17	5		28	17	1		28	17	14	
29	17	26		29	17	22		29	17	18		29	17	30	
30	17	41		30	17	38		30	17	34		30	17	46	

First.			Second.			Third.			Leap yeere		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
1629			1630			1631			1632		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	17	57	1	17	54	1	17	50	1	18	2
2	18	13	2	18	9	2	18	5	2	18	17
3	18	28	3	18	25	3	18	21	3	18	31
4	18	42	4	18	39	4	18	35	4	18	46
5	18	56	5	18	53	5	18	49	5	19	0
6	19	11	6	19	7	6	19	4	6	19	14
7	19	24	7	19	21	7	19	18	7	19	27
8	19	38	8	19	34	8	19	31	8	19	41
9	19	51	9	19	47	9	19	44	9	19	54
10	20	3	10	20	0	10	19	57	10	20	6
11	20	15	11	20	12	11	20	9	11	20	18
12	20	28	12	20	25	12	20	22	12	20	31
13	20	39	13	20	37	13	20	34	13	20	42
14	20	51	14	20	48	14	20	45	14	20	53
15	21	1	15	20	59	15	20	56	15	21	4
16	21	12	16	21	10	16	21	7	16	21	14
17	21	22	17	21	20	17	21	17	17	21	25
18	21	32	18	21	30	18	21	27	18	21	34
19	21	41	19	21	39	19	21	37	19	21	44
20	21	50	20	21	48	20	21	46	20	21	52
21	21	59	21	21	56	21	21	54	21	22	1
22	22	7	22	22	5	22	22	3	22	22	9
23	22	15	23	22	13	23	22	11	23	22	17
24	22	22	24	22	21	24	22	19	24	22	25
25	22	29	25	22	28	25	22	26	25	22	31
26	22	36	26	22	35	26	22	33	26	22	38
27	22	42	27	22	41	27	22	40	27	22	45
28	22	49	28	22	48	28	22	46	28	22	50
29	22	55	29	22	53	29	22	52	29	22	55
30	22	59	30	22	58	30	22	57	30	23	0
31	23	5	31	23	4	31	23	3	31	23	5

North Declination. North Declination. North Declination.

First.				Second.				Third.				Leapyeere.			
1613				1614				1615				1616			
1617				1618				1619				1620			
1621				1622				1623				1624			
1625				1626				1627				1628			
1629				1630				1631				1632			
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.	
1	23	9	North	1	23	8	North	1	23	6	North	1	23	10	North
2	23	13		2	23	12		2	23	11		2	23	14	
3	23	16		3	23	15		3	23	14		3	23	17	
4	23	20		4	23	19		4	23	18		4	23	20	
5	23	23		5	23	22		5	23	22		5	23	23	
6	23	24		6	23	24		6	23	23		6	23	25	
7	23	28		7	23	26		7	23	25		7	23	27	
8	23	28		8	23	28		8	23	27		8	23	18	
9	23	29		9	23	29		9	23	29		9	23	29	
10	23	30		10	23	30		10	23	30		10	23	30	
11	23	30		11	23	30		11	23	30		11	23	30	
12	23	30	Tropick	12	23	30	Tropick	12	23	30	Tropick	12	23	30	Tropick
13	23	29		13	23	30		13	23	30		13	23	29	
14	23	28		14	23	29		14	23	29		14	23	38	
15	23	27		15	23	28		15	23	28		15	23	26	
16	23	25		16	23	26		16	23	26		16	23	24	
17	23	23		17	23	24		17	23	24		17	23	22	
18	23	20		18	23	21		18	23	22		18	23	19	
19	23	17	Declination.	19	23	18	Declination.	19	23	19	Declination.	19	23	16	Declination.
20	23	13		20	23	14		20	23	15		20	23	13	
21	23	10		21	23	11		21	23	12		21	23	8	
22	23	6		22	23	6		22	23	7		22	23	4	
23	23	1		23	23	3		23	23	3		23	22	59	
24	22	55		24	22	57		24	22	58		24	22	54	
25	22	51		25	22	52		25	22	53		25	22	49	
26	22	45		26	22	46		26	22	48		26	22	43	
27	22	38		27	22	40		27	22	42		27	22	37	
28	22	31		28	22	34		28	22	36		28	22	30	
29	22	25		29	22	27		29	22	28		29	22	23	
30	22	17		30	22	19		30	22	21		30	22	15	

First.			Second.			Third.			Leap yeere		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
1629			1630			1631			1632		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	22	9	1	22	11	1	22	13	1	22	8
2	22	1	2	22	3	2	22	5	2	21	59
3	21	52	3	21	55	3	21	56	3	21	50
4	21	44	4	21	46	4	21	48	4	21	41
5	21	34	5	21	37	5	21	39	5	21	32
6	21	25	6	21	27	6	21	29	6	21	22
7	21	15	7	21	18	7	21	20	7	21	12
8	21	4	8	21	7	8	21	9	8	21	1
9	20	54	9	20	56	9	20	59	9	20	51
10	20	43	10	20	46	10	20	48	10	20	39
11	20	31	11	20	34	11	20	37	11	20	28
12	20	19	12	20	23	12	20	25	12	20	16
13	20	7	13	20	10	13	20	13	13	20	3
14	19	54	14	19	57	14	20	0	14	19	51
15	19	42	15	19	45	15	19	48	15	19	38
16	19	28	16	19	32	16	19	35	16	19	25
17	19	15	17	19	18	17	19	21	17	19	11
18	19	2	18	19	4	18	19	8	18	18	58
19	18	47	19	18	50	19	18	43	19	18	43
20	18	32	20	18	36	20	18	39	20	18	29
21	18	18	21	18	22	21	18	25	21	18	14
22	18	3	22	18	6	22	18	10	22	17	59
23	17	47	23	17	51	23	17	55	23	17	44
24	17	32	24	17	36	24	17	40	24	17	29
25	17	16	25	17	20	25	17	25	25	17	12
26	17	0	26	17	5	26	17	8	26	16	56
27	16	43	27	16	47	27	16	52	27	16	39
28	16	27	28	16	31	28	16	35	28	16	23
29	16	10	29	16	15	29	16	19	29	16	5
30	15	53	30	15	57	30	16	2	30	15	48
31	15	34	31	15	40	31	15	44	31	15	30

North Declination. 6

North Declination.

North Declination.

First.			Second.			Third.			Leap yeere.		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
1629			1630			1631			1632		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	15	17	1	15	22	1	15	26	1	15	13
2	14	59	2	15	4	2	15	8	2	14	54
3	14	41	3	14	46	3	14	50	3	14	36
4	14	23	4	14	27	4	14	32	4	14	18
5	14	4	5	14	9	5	14	13	5	13	59
6	13	45	6	13	49	6	13	54	6	13	40
7	13	25	7	13	30	7	13	35	7	13	21
8	13	6	8	13	11	8	13	16	8	13	1
9	12	47	9	12	52	9	12	57	9	12	42
10	12	28	10	12	32	10	12	37	10	12	23
11	12	7	11	12	12	11	12	17	11	12	2
12	11	47	12	11	52	12	11	57	12	11	42
13	11	27	13	11	31	13	11	36	13	11	21
14	11	6	14	11	11	14	11	16	14	11	1
15	10	45	15	10	49	15	10	55	15	10	39
16	10	25	16	10	29	16	10	35	16	10	19
17	10	4	17	10	8	17	10	14	17	9	58
18	9	42	18	9	47	18	9	53	18	9	36
19	9	20	19	9	29	19	9	31	19	9	14
20	8	59	20	9	4	20	9	10	20	8	54
21	8	37	21	8	42	21	8	49	21	8	32
22	8	16	22	8	21	22	8	27	22	8	10
23	7	53	23	7	56	23	8	5	23	7	48
24	7	32	24	7	37	24	7	43	24	7	26
25	7	9	25	7	15	25	7	21	25	7	4
26	6	47	26	6	53	26	6	59	26	6	42
27	6	25	27	6	30	27	6	36	27	6	19
28	6	2	28	6	7	28	6	14	28	5	55
29	5	39	29	5	45	29	5	51	29	5	33
30	5	16	30	5	22	30	5	28	30	5	11
31	4	52	31	5	0	31	5	6	31	4	48

North Declination. North Declination. North Declination.

First.				Second.				Third.				Leap yeere.			
1613				1614				1615				1616			
1617				1618				1619				1620			
1621				1622				1623				1624			
1625				1626				1627				1628			
1629				1630				1631				1632			
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.	
1	4	30		1	4	37		1	4	43		1	4	25	
2	4	8		2	4	14		2	4	20		2	4	2	
3	3	45		3	3	51		3	3	57		3	3	40	
4	3	22		4	3	28		4	3	34		4	3	16	
5	2	59		5	3	5		5	3	11		5	2	53	
6	2	35		6	2	42		6	2	47		6	2	29	
7	2	12		7	2	18		7	2	23		7	2	7	
8	1	49		8	1	56		8	2	1		8	1	42	
9	1	25		9	1	31		9	1	37		9	1	20	
10	1	2		10	1	9		10	1	14		10	0	57	
11	0	39		11	0	48		11	0	51		11	0	33	
12	0	15		12	0	21		12	0	27		12	0	9	
13	0	8	Equi-	13	0	2	noctii	13	0	4	all.	13	0	14	
14	0	32		14	0	26		14	0	19		14	0	38	
15	0	55		15	0	49		15	0	43		15	1	1	
16	1	19		16	1	12		16	1	7		16	1	25	
17	1	42		17	1	35		17	1	30		17	1	47	
18	2	6		18	2	0		18	1	53		18	2	12	
19	2	29		19	2	23		19	2	17		19	2	35	
20	2	52		20	2	47		20	2	40		20	2	59	
21	3	16		21	3	11		21	3	3		21	3	22	
22	3	40		22	3	34		22	3	27		22	3	45	
23	4	2		23	3	56		23	3	51		23	4	8	
24	4	26		24	4	20		24	4	13		24	4	32	
25	4	49		25	4	43		25	4	37		25	4	55	
26	5	13		26	5	7		26	5	0		26	5	18	
27	5	35		27	5	29		27	5	23		27	5	41	
28	5	58		28	5	52		28	5	46		28	6	4	
29	6	22		29	6	15		29	6	9		29	6	27	
30	6	45		30	6	39		30	6	33		30	6	50	

North Declination. South Declination.

North Declination. South Declination.

North Declination. South Declination.

First.			Second.			Third.			Leap yeere		
1613			1614			1615			1616		
1617			1618			1619			1620		
1621			1622			1623			1624		
1625			1626			1627			1628		
1629			1630			1631			1632		
D.	G.	M.	D.	G.	M.	D.	G.	M.	D.	G.	M.
1	7	7	1	7	2	1	6	56	1	7	13
2	7	30	2	7	25	2	7	19	2	7	36
3	7	52	3	7	47	3	7	41	3	7	58
4	8	15	4	8	9	4	8	3	4	8	20
5	8	37	5	8	32	5	8	26	5	8	42
6	8	59	6	8	53	6	8	48	6	9	5
7	9	21	7	9	16	7	9	10	7	9	27
8	9	43	8	9	38	8	9	32	8	9	49
9	10	5	9	10	0	9	9	54	9	10	11
10	10	27	10	10	22	10	10	16	10	10	33
11	10	48	11	10	43	11	10	38	11	10	54
12	11	10	12	11	4	12	10	59	12	11	16
13	11	31	13	11	26	13	11	20	13	11	36
14	11	52	14	11	47	14	11	41	14	11	57
15	12	13	15	12	8	15	12	2	15	12	18
16	12	34	16	12	29	16	12	23	16	12	39
17	12	54	17	12	50	17	12	44	17	12	59
18	13	14	18	13	10	18	13	4	18	13	19
19	13	34	19	13	30	19	13	24	19	13	39
20	13	54	20	13	50	20	13	44	20	14	0
21	14	14	21	14	10	21	14	4	21	14	20
22	14	33	22	14	29	22	14	24	22	14	39
23	14	52	23	14	48	23	14	44	23	14	58
24	15	12	24	15	9	24	15	2	24	15	17
25	15	29	25	15	25	25	15	20	25	15	35
26	15	48	26	15	43	26	15	38	26	15	52
27	16	6	27	16	2	27	15	57	27	16	12
28	16	25	28	16	20	28	16	15	28	16	30
29	16	42	29	16	38	29	16	33	29	16	46
30	16	59	30	16	55	30	16	50	30	17	4
31	17	16	31	17	12	31	17	7	31	17	21

South Declination.

South Declination.

South Declination.

November.

First.				Second.				Third.				Leap yeere			
1613				1614				1615				1616			
1617				1618				1619				1620			
1621				1622				1623				1624			
1625				1626				1627				1628			
1629				1630				1631				1632			
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.	
1	17	33		1	17	29		1	17	24		1	17	37	
2	17	49		2	17	45		2	17	41		2	17	53	
3	18	5		3	18	1		3	17	57		3	18	9	
4	18	21		4	18	17		4	18	13		4	18	25	
5	18	36		5	18	33		5	18	29		5	18	40	
6	18	51		6	18	47		6	18	44		6	18	55	
7	19	6		7	19	2		7	18	59		7	19	10	
8	19	20		8	19	17		8	19	14		8	19	24	
9	19	35		9	19	31		9	19	28		9	19	38	
10	19	49	South Declination.	10	19	45	South Declination.	10	19	42	South Declination.	10	19	52	
11	20	2		11	19	59		11	19	56		11	20	5	
12	20	15		12	20	12		12	20	9		12	20	18	
13	20	28		13	20	25		13	20	22		13	20	31	
14	20	40		14	20	37		14	20	34		14	20	43	
15	20	52		15	20	49		15	20	46		15	20	55	
16	21	3		16	21	0		16	20	58		16	21	6	
17	21	14		17	21	11		17	21	9		17	21	17	
18	21	25		18	21	22		18	21	20		18	21	28	
19	21	35		19	21	33		19	21	30		19	21	38	
20	21	45		20	21	43		20	21	40		20	21	48	
21	21	54		21	21	52		21	21	50		21	21	57	
22	22	3		22	22	1		22	21	59		22	22	6	
23	22	13		23	22	10		23	22	8		23	22	14	
24	22	20		24	22	18		24	22	17		24	22	22	
25	22	28		25	22	26		25	22	25		25	22	30	
26	22	35		26	22	33		26	22	32		26	22	37	
27	22	42		27	22	40		27	22	39		27	22	44	
28	22	49		28	22	47		28	22	46		28	22	51	
29	22	55		29	22	52		29	22	52		29	22	57	
30	23	0		30	22	58		30	22	57		30	23	2	

First.				Second.				Third.				Leap yeere.			
1613				1614				1615				1616			
1617				1618				1619				1620			
1621				1622				1623				1624			
1625				1626				1627				1628			
1629				1630				1631				1632			
D.	G.	M.		D.	G.	M.		D.	G.	M.		D.	G.	M.	
1	23	5	South	1	23	4	South	1	23	3	South	1	22	6	South
2	23	9		2	23	8		2	23	7		2	23	10	
3	23	14		3	23	13		3	23	12		3	23	15	
4	23	17		4	23	16		4	23	15		4	23	19	
5	23	21		5	23	20		5	23	19		5	23	22	
6	23	23		6	23	23		6	23	22		6	23	24	
7	23	25		7	23	25		7	23	24		7	23	26	
8	23	27		8	23	27		8	23	26		8	23	28	
9	23	29		9	23	29		9	23	28		9	23	29	
10	23	30		10	23	30		10	23	29		10	23	30	
11	23	30	Tropick	11	23	30	Tropick	11	23	30	Tropick	11	23	30	Tropick
12	23	30		12	23	30		12	23	30		12	23	30	
13	23	29		13	23	30		13	23	30		13	23	29	
14	23	28		14	23	29		14	23	29		14	23	28	
15	23	26		15	23	27		15	23	28		15	23	26	
16	23	24		16	23	25		16	23	26		16	23	24	
17	23	22		17	23	23		17	23	24		17	23	22	
18	23	19		18	23	20		18	23	21		18	23	19	
19	23	15		19	23	17		19	23	18		19	23	15	
20	23	11		20	23	13		20	23	14		20	23	11	
21	23	7		21	23	9		21	23	10		21	23	6	
22	23	2		22	23	4		22	23	5		22	23	2	
23	22	57		23	22	59		23	23	0		23	22	56	
24	22	52		24	22	53		24	22	54		24	22	50	
25	22	46		25	22	48		25	22	49		25	22	44	
26	22	39		26	22	41		26	22	43		26	22	37	
27	22	32		27	22	33		27	22	35		27	22	30	
28	22	24		28	22	26		28	22	28		28	22	23	
29	22	16		29	22	19		29	22	21		29	22	14	
30	22	8		30	22	10		30	22	12		30	22	6	
31	21	59		31	22	1		31	22	4		31	21	57	

How to vse the Sunnes Declination, to know the Poles Eleuation.

FIrſt conſider, whether the Sun hath Nozth oz South Declination, which you ſhall know by the fozmer Tables, if the Sun hath Nozth Declination, ſubſtract the Meridian Altitude thereof from 90. and to the reſt adde the Declination foz the day propoſed: but if the Sun hath South Declination, adde the Declination to the Meridian Altitude, the ſame ſubſtract from 90. the reſt is the eleuation of the Pole. Example: at London, the 16. of April, 1616. the Declination is Nozth 13. degrées 41. minutes, and the height of the Sun vpon the Meridian, is 52. degrées 9. minutes, which taken from 90. reſts 37. degrees, 51. minutes, the ſame added to the Declination, 13. degrees, 41. minutes, makes 51. degrees, 32. minutes, and ſo much is the height of the Pole. Againe, the 21. of Ianuarie, the Sun hath South Declination, 17. degrees, 31. minutes, and I find the Meridian Altitude to be 20. degrees, 57. minutes, which added together, makes 38. degrees, 28. minutes, the ſame ſubſtract from 90. degrees, reſts 51. degrees, 32. minutes, the Eleuation afozeſaid. But this is vnderſtood, when you know certainly on which ſide of the Equinoctiall you are, to know which, doe thus: if the Sun caſt his ſhadow that way that hee is from the Equinoctial, he is betwixt you and it: if the Sun hauing Nozth Declination, giue a South ſhadow, oz South Declination, giue a Nozth ſhadow, then is the Equatoz betwixt you and the Sun, oz you in the Equatoz, oz you betwixt the Equatoz and the Sun, to know which, adde the Declination to the Meridian Altitude, if it bee leſſe then 90. ſo much as wanteth of 90. is your diſtance from the Equatoz, on that ſide which the ſhadow ſtriketh, but if it amount to 90. then are you vnder the Equatoz, if moze then 90. ſo much as is the ouerplus are you from the Equatoz towards the Sunne, and then are you betwixt the Equatoz and the Sunne, alſo if the Meridian Altitude be equall with your Zenith, ſo much as is the Declination of the Sunne, are you diſtant from the Equatoz on that ſide wherein the Sun is, but if the Sunne haue no Declination, then are you vnder the Equinoctiall.

CHAP.

Chap. V.

Of the entrance of the Sun into the twelue Signes, and of the Equinoctials, and Solsticials, which diuide the foure times of the Yeere.

OF that it is said in the Chapter before, it followeth, that the Sun entring into the foure principall Signes, causeth the foure times of the yeere. For entring into Aries, it changeth the time to vs from Winter to the Spring-time, and entring into Cancer, it changeth the time from Spring to Summer: And entring into Libra, from Summer to Autumne. Likewise entring into Capricorne, it changeth from Autumne to Winter. So that when to vs that be on the part of the North, is Summer, then is it Winter to them that are on the South part. Or contrariwise being Summer to them on the South, it is Winter to them on the North. The entrance of the Sunne into these Signes, and all other of the Zodiacke, hath not béene euer at one selfe-same time of the yeere. The cause of this is, that the Lattne yeere is not equal with the mouing of the Sun in the Zodiacke, as shall be said in the 10. Chapter, where we wil intreat of the yeare. In the time that Christ our Redeemer was borne, were the Equinoctials, the one at the eight of the Kalends of April, and the other at fiue of the Kalends of October: so that they had the Equinoctiall of the Spring, at the 25. of March, and the Equinoctiall of Autumne, at the 27. of September, as writeth Iohn Baptist Capuano vpon the second chapter of the Sphere of Iohan de sacro Bosco. They iudged then the Solsticials, as that of the Summer, at the eight day of the Kalends of Iuly, which is the 24. of Iune: the other of the Winter, they iudged at the eight day of the Kalends of Ianuarie, which is the 25. of December. And here will not I omit to say, how in those times, these foure dayes (that is to meane, in the two Solsticials, and two Equinoctials) were celebrated, or did chance foure miraculous things in the World.

For

For in the spring Equinoctiall, which was at ♈ 25. of March, the Sonne of God was incarnate, and afterward borne of the Virgin Marie in the Solsticiall of Winter, which was at the 25. of December. In the Equinoctiall of Autumne, which was the 27. of September, was conceiued blessed Iohn Baptist, the Cryer and Precursor of Christ, and was borne in the Summer Solsticiall, that was the 24. of Iune. And this is the sixth Poneth whereof Saint Luke speaketh in the Gospell. Which thing also Iohn Chrysostome doth verifie, saying that Saint Iohn was borne when the dayes beganne to decrease, and our Lord, when they beganne to increase. And it may certainly seeme worthie to be had in memorie, that in the said Equinoctiall of the Spring, Christ suffered, Adam was created, and lost the estate of Innocencie, Abel was slaine, Melchisedech offered Bread and Wine: Isaack by Abraham was brought to bee sacrificed: Iohn Baptist was beheaded at Micherunta, Peter deliuered out of Prison, Saint Iames beheaded by Herod, the good Theefe inioyed Paradise, and the bodies of many Saints rose with Christ: and who so further desireth more precisely to know the entrance of the Sun into Aries, and into the other principall Signes, shall in the third part of this worke in the eighth Chapter, finde rules which shall bring him to the knowledge thereof. But to returne to our time, I say, this present yeare of 1615. the Sun entreth

Into ♈ the 11. of March, at neare 4. a clock in the morning.
Into ♉ the 10. of April, at noone.
Into ♊ the 11. of May, 2. houres after noone.
Into ♋ the 11. of Iune, eleuen houres after noone.
Into ♌ the 13. of Iuly, at one a clocke after noone.
Into ♍ the 13. of August, two houres after noone.
Into ♎ the 13. of September, two houres after noone.
Into ♏ the 13. of October, eleuen houres after noone.
Into ♐ the 12. of November, two houres after noone.
Into ♑ the 11. of December, 11. houres after noone.
Into ♒ the 10. of Ianuarie, 8. houres before noone.
Into ♓ the 8. of February, 8. houres after noone.

And for to know the certaine time of the Suns entrance into each Signe, for any yeere hereafter, you muſt adde for euery yeere fiue houres, and 49. minutes, which is the ouerplus that each yeere hath, ſo that in foure yeeres it comes to one naturall day, which is added to Februarie, making it thereby to haue 29. dayes, which in other yeeres hath but 28. and then pulling one day backe againe from the yeere 1596. and to that which remaineth, adde to the yeere 1597. 5. houres 49. minutes, and as much more euery yeere following, which ſhall be a certaine rule for euer.

Now you muſt note, that the degrees and minutes which are here noted, are properly for the Citie of London, whoſe Longitudes are 25. degrees, 50'. and if you deſire to apply them for places more Eaſtward, then for euery 15. degrees difference in Longitude, you muſt adde one houre, and if for places more Weſtward, for euery 15. degrees difference of Longitude, you muſt ſubtract one houre, by reaſon of the Suns rapt mouing from the Eaſt to the Weſt, for it is certaine, that when with vs in London it is twelue of the clock, to them of Meiſſen, which is fifteene degrees to the Eaſtward of vs, it is one of the clock, and to them of Forteuentura, which are 15. degrees to the Weſt of vs, it is but 11. of the clocke.

Now that we haue Rules to know the entrance of the Sun into the twelue Signes, thereby may wee alſo know his entrance into the foure Cardinall or Principall Signes, which are they that determine and end the Equinoctials and Solſticials, whereby are cauſed the foure times of the yeare. And foraſmuch as the generall change of times, is by reaſon of the Sunne, who by his comming neere, warmeth: by his remaining, dryeth: with his departure, coleth and by his long tarrying away, cauſeth moyſtneſſe, we will ſhew the qualities of the principall Windes, Elements, Regions, Humours, and Ages, in one briefe Table, and then conſequently in an other will we deſcribe the beginning, midſt and end of the foure times of the yeare, aſwell in the moneths, as in the Heauenly Signes.

The

The Table of the Qualities of the Elements.

Qualities.	hot & drie	hot & moyst	cold & moyst	cold & drie.
parts of ỹ yeere	Summer	Spring.	Winter.	Autumne.
principal winds	East.	South.	West.	North.
Elements.	Fire.	Ayre.	Water.	Earth.
Regions.	East.	South.	West.	North.
4. Humours.	Choler.	Blood.	Flegme.	Melăcholy.
4. Ages.	Youth.	Mās state.	Aged.	Age.

The Table of the foure times of the Yeere.

Times.	Beginning.	Middest.	End.
Spring.	March. Aries.	Aprill. Taurus.	May. Gem.
Summer.	June. Cancer.	July. Leo.	August. Virgo.
Autumne.	Septemb. Libra.	Octob. Scorp.	Novemb. Gem.
Winter.	Decem. Capric.	Janu. Aquarius.	February. Pisces

Chap. V.
Of the Moone and of her Motions and Properties.

IN the Chapters past of this second part, we haue intreated of the Sun, and of his motions and effects, as the most noble and principal Luminarie. In this present Chapter we will intreat of the Moone, which is the second Luminarie, although in the order of the Heauens she is the first, and nearest vnto vs of all other Planets or Stars: The Moone therefore is a round body, of heauenly substance, solid and darke in respect of the Sun, hauing no proper light of her owne, but is apt to receiue light. She is moued from the West

into the Eaſt, according to the order of the Signes, euery day thirtéene degrées, little more or leſſe, and ſomewhat more then ten minutes, by the proper motion of the Heauen or Sphere, vpon the Axes and Poles of the Zodiacke, I ſay more or leſſe, becauſe that ouer and beſide the moning of her Deferent or Circle, which is moued euery day the aforeſaid thirtéene degrées, and ten minutes, almoſt eleuen, ſhe hath an Epicicle, where the Mone is fixed: at the motion whereof, ſometimes ſhée is moued more ſwiftly, and ſometimes more ſlowly: Neuertheleſſe, according to her ſelfe motion, ſhee maketh her courſe in ſeuen and twentie dayes and almoſt 8. houres, and hauing no light of her owne, ſhee is lightned of the Sunne, as manifeſtly appeareth hereby, that being in Coniunction with the Sun, or néere vnto him, we ſée her not lightned, becauſe the light which ſhee then receiueth, is onely her vppermoſt or higheſt part, whereby ſhe directly beholdeth the Sun, foraſmuch as he is in the fourth Heauen, and ſhée in the firſt. And departing from the Sun by her proper moning, the Sun remaineth on the Weſt part. Then toward that part we begin to ſée a little of the part of the Mone lightned, and ſo more and more by little and little as ſhe departeth further from the Sun. And at this time ſhee hath her hornes or corners toward the Eaſt, becauſe the Sun is in the Weſt: during this time alſo, ſhe is ſaid to increaſe, or that ſhe goeth increaſing vnto the oppoſition which wee ſée by the part of her, which the Sun directly beholdeth. And ſo wee ſée her altogether lightned, and call it the full Mone. Then paſſing from the Oppoſition, ſhe commeth nérer the Sunne by little and little, being darkned and hid from vs, and lightned onely by her higheſt part, and this time is called the decreaſing or Wayne of the Mone. Then alſo hath ſhe her hornes toward the Weſt, becauſe the Sun is in the Eaſt: and this vntill ſhé turne againe in coniunction with the Sun, and that wee ſee her not lightned at all.

The Mone is leſſe then the Starres or other Planets, except Mercurie, and leſſe then the Earth. And if any ſhall affirme

firme the contrarie, ſaying that it is written in Geneſis, that God made two great lights, the greateſt, to giue light to the day, & the leſſe to lighten the night (as Dauid alſo affirmeth.) To this I anſwere, that the Moone being neereſt vnto the Earth, appeareth vnto vs greater then ſhe ſhould doe, if ſhe were further diſtant from vs. And although ſhee bee great of light (receiued as wee haue ſaid) and bigge of bodie, yet is ſhe not great in reſpect of the other Starres. And therefore the words of Geneſis aforeſaid, may be vnderſtood to be ſpoken in ſuch manner and phraſe, as Holy Scripture often vſeth to humble and apply it ſelfe to the weakneſſe of our vnderſtanding, and groſeneſſe of our ſences.

Chap. VI.

Of the Coniunctions and Oppoſitions of the Sunne and the Moone.

The Sun and the Moone are moued vnder the Zodiacke with diuers motions. The Moone with a ſwifter motion then the Sunne followeth him, ouertaketh him, and goeth before him, vntill ſhee place her ſelfe in Diameter with him. And when ſhe hath thus ouertaken him, ſo that they are both in one ſelfe ſame degrée of the Zodiacke, then is the Coniunction. Then departing from him, and being in equall degrées of the Signes oppoſite according to the Diameter, is the Oppoſition. To know the time of theſe Coniunctions and Oppoſitions, is very profitable and neceſſarie for Mariners. Theſe times may be knowne in two manners: One way, by by the Ephemerides or Almanacke, or other Tables, or Lunarie Inſtruments. And by theſe meanes is knowne preciſely the day, houre, and minute of the Coniunction and Oppoſition. It may likewiſe be knowne by the Rules of Computation, which are the Rules that are knowne by memory, although not preciſely, as by the Bookes aforeſaid. And here is to be vnderſtood, that from one Coniunction to another, according to the halfe mouings of the Sun & ☽ Moone,

there palleth 29. dayes twelue houres, and fortie foure minutes. And consequently from Coniunction to Oppolition, and from Oppolition to coniunction, the halfe thereof, which is fourteene dayes, eighténe houres, and twentie two minutes. To know these Coniunctions by Rules of computation, is presupposed to know the Golden number, and by it the Concurrent or Epact.

The Golden Number, is the number of nineteene yéres. In which time the Coniunctions of the Sun and the Moone make all their varieties in the times of euery yére: so that if the Coniunction were the eightéenth day of March in the yére 1609. from this yére in the nineteenth yére following, which shall be in the yére 1628. the Coniunction shall returne to be at the eightéenth day of March. It was first called the Golden Number by the Egyptians, who first found the vse thereof, and sent it to Rome written in Golden Letters. To find this number, it is needfull to know his rotes, which is this. In the yére that Christ our Lord and Redéemer was borne (whereby wee make this account) the Golden Number was the number of one, which was the yére of the rot or beginning: & the first yére of the birth of Christ, was two of the Golden Number: so that ioyning to the yéres of our Lord, one of the rot or beginning, and from all take away the ninetine, then the rest shall bee the Golden Number. And if you desire to make computation by a nérer rot, take for the rot the yére of 1500, when nineteene was the Golden Number, and in the yére of 1501. did begin one of the Golden Number, and so consequently, euer taking away the ninténe.

This présent yére 1615. wee haue 1. of the Golden Number, and in the yére of 1616, we shall haue 2.

The Golden Number being knowne, it is necessarie for this computation of the Moone to know the Concurrent, or Epact. The Concurrent of euerie yére, is the number of the dayes passed of the Coniunction of the Moone, at the beginning of March. And these grow of the difference of the

Solar

Solar yére to the Lunar: As the Lunar yére hath 354. dayes, and the Solar yére 365, ſo háuing [illegible] yére eleuen dayes of difference, which are added euery yére vntill they come to the number of thirtie, and paſſing thirtie, thoſe that doe paſſe, are of the Concurrent.

The number of the Concurrent of euery yére is found in this manner.

And the better to beare it in memorie, you muſt imagine thrée places, and theſe commonly are aſſigned on the thumbe. As the firſt place at the rot of the thumbe, the ſecond in the middle ioynt thereof, and the third and laſt in the toppe of the thumbe. Then in the firſt place put ten, in the ſecond twentie, and in the third thirtie. Then by the order of theſe places ſhall bee counted the Golden Number: as one in the firſt place, two in the ſecond, and thrée in the third, returning ſoare to the firſt place, &c. vntill the Golden Number of that yére for the which the Concurrent is ſought. And the number of that place where the Golden Number endeth, muſt be ioyned with the number of the Golden Number, and that doth amount thereof ſhall be the Concurrent, ſo that it paſſe not thirtie, but if it paſſe thirtie, then that, that is more then thirtie, is the Concurrent of that yére.

And here is to be noted, that the yáres of this computation of the Mone, begin at the firſt day of March, and laſt vntil the laſt day of Februarie, ſo that this preſent yére 1615. by computation of the Golden Number, we haue 1. which accounted by the ſaid places, endeth in the firſt place, which is 10. the ſame ioyned with the Golden Number of 1. makes 11. which being leſſe then thirtie, the ſaid 11. is the Epact or Concurrent of this preſent yére of our Lord, a thouſand ſix hundred and fiftéene.

Likewiſe this number of Epact or Concurrent is found in multiplying the Golden Number by 11. and deuiding the ſumme by 30. then that remaineth, is the Epact or Concurrent.

The Concurrent being thus knowne, then to know the dayes of the Moone, it is necessarie to know three numbers: the first, is the Concurrent, the second, the number of the Moneth in which you are, beginning at March: the third, the dayes past of the same moneth. And ioyning these three numbers, if they come not to 30, so many dayes olde is the Moone. And if they bee thirtie, it is the Coniunction. And if they passe thirtie, they also that passe, are the age of the Moone.

This is vnderstood in the Moneths that haue one and thirtie dayes, for in them that haue onely thirtie dayes, the Coniunction is at the nine and twentieth day, and they that arise of nine and twentie, are the age of the Moone. As for example, the first day of August, of the Epact, eleuen Moneths from March fire, and dayes of the Moneth, one, make in all eighteene, and so much is the age of the Moone for the day aforesaid.

Againe, the twentieth day of September, when the Epact is foure, of Moneths, seuen, and dayes of the Moneth, twentie, makes thirtie one: and because that September hath but thirtie dayes, wee must take away twentie nine from thirtie one, so there resteth two dayes which are the age of the Moone: so in like manner, wee must giue to February 29. dayes of the Moone.

It followeth, that the dayes of thee Moone being knowne, then vnreckoning or disreckoning backeward, wee finde for example. The twentieth of October the Moone hath two dayes, which taken from thethirtieth, remaineth eighteene, then the eighteenth day was the Coniunction.

The day of the Coniunction is likewise knowne by ioyning the Moneths (beginning in March) with the Concurrent, and if they come not to thirtie, then at so many dayes of that Moneth as lacketh of thirtie, shall bee the Coniunction.

Example.

Example.

In Auguſt of the moneths 6, and of the Concurrent or Epact 4. are 10, which wanteth of 30. 20. then at the 20. day was the Coniunction, but if it be ſo that they paſſe 30, then taking them that paſſe 30. from the number of dayes, which the moneth next before had, that which remaineth doth ſhew the day of the Coniunction: As for example, the moneth of December of the yeere 1610, we had of the Epact 26, which added with 10, the number of moneths from March, make 36, then ſubſtract 6, the ouerplus of 30, from 30, the daies of Nouember, the moneth next before, and there remaineth 24: then I conclude, that the 24. of Nouember 1610, the Mone was in Coniunction.

Chap. VII.

Of the Declination and Vſe of an Inſtrument, by the which is found the place and Declination of the Sunne, with the dayes and place of the Moone.

IN the ſecond and third Chapter I haue giuen Rules to know the true place of the Sun, and his Declination. In this Chapter I will deſcribe an Inſtrument, whereby may bee knowne the Declination and place of the Sunne, and knowing by the Chapter paſt, the dayes of the Mone, ſhall alſo be knowne her place in the Zodiacke, and how much of her is lightned, and what aſpect ſhee hath with the Sunne.

This Inſtrument is in ſquare forme, and hath by the ſides 23. degrees and a halfe, of the which the 23. and a halfe, that deſcend from the middeſt downeward, is the Declination of the South Signes: and the other from the middeſt vpward, are the declinations of the North Signes: Within this Quadrature is deſcribed a Circle, by the Circumference whereof are the twelue Signes, and their degrees ioyned to the Circumference: and further within, is the number of them,

and

and then their names. Yet further within this, is another Circle, where are the twelue moneths, with their numbers and dayes.

Then to the Center of this Circle, are annexed two rundels, whereof the greatest and lowest is called the rundell of the Sun.

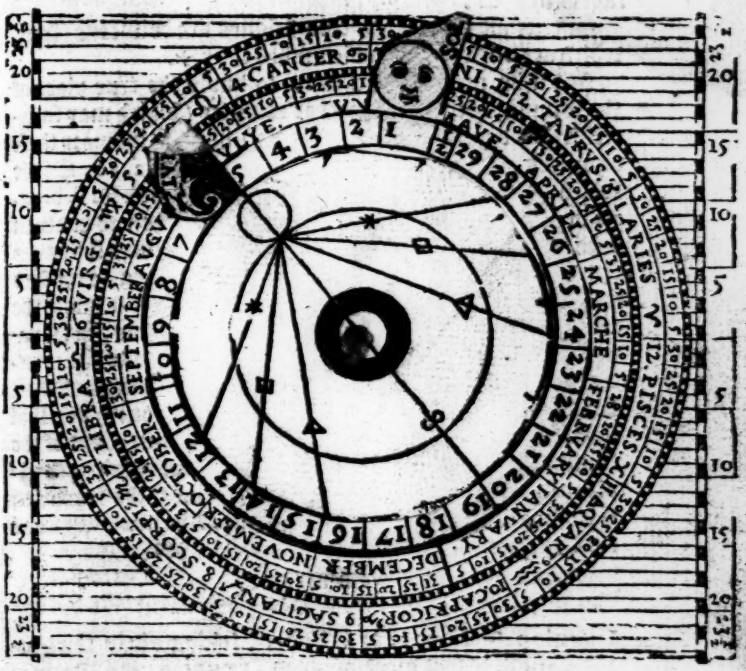
This hath an Inder or Shewer, in which is pointed the Sunne, and in the Circumference of it, are the dayes of the age of the Moone. In the other Circle, in the Circumference thereof, is a round hole, representing the Moone, directly from the which, is another Inder comming forth of the Circumference of this rundell, in which rundell are all the Aspects, which the Moone maketh with the Sun.

Hauing described the Instrument, let vs declare the vse thereof. which is this.

First, to find the true place of the Sunne, we must put the Inder of the rundell of the Sun, vpon the day of the moneth in which wee are, or desire to know the place of the Sunne: then in the Circle of the Signes it shall shew the Signe and degree in the which it is, and in like manner, resting still vpon the degree, looking in the Parales that touch in the Circumference, and proceeding by that line that toucheth the Sun, which the Inder doth note, ye shall see in the side of the Instrument, the number of the degrees of the Declination, which the Sun hath at that day.

To finde the place of the Moone, wee must hold the Inder of the rundell of the Sun, fast vpon that day of the moneth, in the which we desire to know the place of the Moone: And accounting in the rundell of the Sun, the dayes that haue passed from the day of the Coniunction (as I haue said in the Chapter before) and where endeth that number of the daies, if there we apply the Inder of the Moone, it shall shew in the Circle of the Signes, the place where she is. And so shall shee appeare in the Instrument lightned or darkned, more or lesse as in Heauen. In like manner, considering the place of the Sun and the Moone, shall be seene what aspect they haue by the

the Lines that traverse the Superficiall of the Lunar Circle of the Mone.



The Aspects which the Planets haue one to another, or whereby they behold one another, are fiue.

Coniunction is, when two Planets bee vnder one selfe same degrée and minute in the Zodiacke, whose Charact is this ☌.

Oppositiõ is, when betwéene the place of the Planets is halfe a circle, where are 180. degrées, & is thus figured, ☍.

Trinall Aspect is when betwéene the Planets shall bée 4. Signes, which are 120. degrées, and is figured thus, △.

Qua-

Quadrine aſpect is, when one Planet is diſtant from another by three Signes, which are 90. degrées, whoſe Charact is this, □.

Sextile aſpect is, when two Signes are betweene them, which are 60. degrées, and is maked thus, ✶.

And if by memory you deſire to know the true place of the Sunne, without reſpect of minutes (which may ſufficiently bée done with the Aſtrolabie) beare in memory theſe numbers, 9. 8. 10. 10. 11. 11. 13. 13. 13. 13. 12. 11. Of the which the firſt ſerueth for Ianuarie, the ſecond for Februarie with their Signes, and ſo of the reſt: then to know in what Degree the Sunne is, you ſhall take away the dayes that are applyed to euery moneth, according to the ſaid numbers of the dayes, for the which you deſire to know the true place of the Sunne, and in them that remaine, in ſo many degrées is the Sunne of the Signe, into the which it entreth that moneth: And if the dayes paſt of the moneth, ſhall bée leſſe then the dayes applyed to the ſame moneth, you ſhal ioyne thirtie with thoſe dayes paſt of the moneth, and of the ſumme that amounteth, you ſhall take away the dayes applyed to the ſaid moneth, and the reſt ſhall bee the degrées in which the Sunne ſhall bée of the Signe of the moneth paſt, as for Example.

Example.

Ianuarie 9. ♒ The 22. of October, taking away thirténe
Februarie 8. ♓ that were applyed, remaine nine Degrees
March. 10. ♈ of Scorpio, where the Sun is.
April. 10. ♉.

Another Example.

May. 11. ♊ The firſt of December, which are leſſer
June. 11. ♋ then twelue, which is applyed vnto it, if wée
July. 13. ♌ ioyne fiue to thirtie, which are the dayes

of

August. 13. ♍ of the moneth next afore, they make 36.
September. 13. ♎ and from them wee take away the 12. rest
October. 13. ♏ 24. so is 24. degrées, is the Sun of the Signe
Nouember. 12. ♐ of the moneth before, which is Sagitta-
December. 12. ♑ rie.

Chap. VIII.
Of the Eclipse of the Moone and the Sunne.

THe Eclipse of the Sun and of the Moone, is a thing that causeth great feare and admiration among the common and ignorant people, and to them that vnderstand the cause thereof, nothing at all. And therefore haue I thought good to declare the effects therof.

The Eclipse of the Moone, is the interposition or being of the Earth, betwixt her and the Sun. And wheras the Moone hath no proper light of her owne, and the Earth being darke and not transparent, maketh his shadow on the part opposite to the Sunne: the Moone by her proper motion doth passe by this shadow, and is eclipsed or darkned eyther in the whole or in part, according to the portion of her that passeth by the shadow. Moreouer, (as wee haue said) that onely the Sunne is moued in the Line Ecliptick, and the Earth beeing in the Center of the World, the point or prick of the shadow shall bee vnder the Ecliptick. The Moone declineth from the Ecliptick, sometimes to the one part, and sometimes to the other, because her Eccentrick wherein shee is moued, doth cut the Ecliptick, equally into two halfes, so that the one halfe of the Eccentricke doth decline from the Ecliptick toward the North part, and the other halfe toward the South, and the greatest Declination of it from the Ecliptick, is fiue degrées. In that manner the Moone shall be at no time in the Ecliptick, but onely when she shalbe in either of the intersections, where the Eccentrick doth cut the said Ecliptick. That inter section where shee passeth and goeth toward the North part, is called the head of

the

the Dragon, and is marked thus ☊. The other where thee passeth and declineth toward the South part, is called the tayle of the Dragon, and is marked thus ☋. And the Sunne moving by his proper motion, and comming to the head, then shall the shadow of the Earth bee in the tayle, because it is the point opposite: and if then the Moone come thither, of her proper motion she passeth by the shadow, and lacking light of the Sun, she is eclipsed: & if the Sun come to the tayle, the shadow is in the head, & then likewise shall the Moone be eclipsed, if shee passe by the head.

It is to bee vnderstood, that the Sunne is much bigger then the Earth, and by perspective, the shadow of the Earth, in how much the further it parteth from it, becommeth sharper and sharper, vntill it come to a point: so that the shadow of the whole Earth is pyramidally sharp: and as the Moone is lesse then the Earth, yet (although his shadow goeth sharpning) it sufficeth to eclipse the Moone, if shee passe by the middest thereof.

The Eclipse of the Sun is the interposition of the Moone betweene vs and the Sunne, as if the Sunne bee in the fourth Heauen, and the Moone in the first, she being a darke bodie, and by her proper motion ouertake the Sunne, then putting her selfe betweene him and vs,

the

the couereth him in part, or in the whole: and this is the Eclipſe of the Sun: as the Sunne alſo goeth euer vnder the Ecliptikes, at that time that hee commeth to the head or tayle of the Dragon, if then the Moone make coniunction with him, ſhall be the Eclipſe of the Sunne, foraſmuch as they are both vnder the Ecliptike.

The Eclipſe of the Sun cannot be vniuerſall in the whole Earth, I ſay, vnto all them that may ſee the Sun at the time of the Eclipſe, as is the Eclipſe of the Moone vniuerſall. For if the Moone haue one part eclipſed, all that may ſee here, ſhal ſee her eclipſed: But the Sun ſome may ſee al wholy eclipſed, and other in part, or other alſo not at all eclipſed: and this all at one ſelfe ſame time. The cauſe whereof, is the diuerſitie of the aſpect, which is, to ſee the Moone in the Zodiacke out of her place, as if the Sunne and Moone ſhould make coniunction in the beginning of Aries, and in the head of the Dragon, they that then ſhould be in the Equinoctiall, vnder the Sunne and the Moone, or that the Sunne and the Moone ſhould be in their Zenith, they ſhould ſee the Moone hide all the Sunne.

And they that would be in the Northy Climates, ſhould ſée that the Moone hideth or darkneth onely the South part of the Sun and not all: againe, they on the South part, ſhould ſee the Moone hide the Northy part of the Sunne, and not all: and if at the time of the Coniunction, ſhee haue a little paſſed the head of the Dragon, or lacke a little to come to the tayle, ſo that ſhe be in the Northy Latitude, they that then ſhould be in the Northy Climates, ſhould ſee the Moone eclipſe all the Sunne, and they of the Equinoctiall ſhould ſee onely the Northy part of the Sunne eclipſed, and they of the South ſhould ſee him nothing at all eclipſed: ſo that although the Eclipſe of the Sun ſhall be totall or particular, it cannot bee vniuerſall in the whole Earth.

And note, that for the quantitie of theſe Eclipſes, the Aſtronomers diuide into twelue equall parts, aſwell the Diameter of the Sunn, as of the Moone, and theſe parts they call Figures,

gures, Puncts or Prickes, and according to the Puncts of the Diameter of the Moone, which is couered by the shadow of the Earth, or the partes of the Diameter of the Sunne, which the Moone doth couer, so many fingers or Puncts shal be said to be Eclipsed: as if 6. the halfe, if 3. a quarter, if 4. a Terce, or third part, if 9. three quarters, if 8. two Terces.

It is also to be noted, that although the Sun bee bigger then the Moone, yet at sometimes the Moone seemeth greater then the Sun: and this shalbe when the Sun is in the Auge of the Eccentricke, and the Moone in the opposite of the Auge of the Epicicle.

And when it so appeareth, he may be all eclipsed. Sometimes also the Moone seemeth lesse: this is when the Sun is in the opposite of the Auge of the Eccentrick, and the Moone in the Auge of the Epicicle: then although we should see the center of the Moone in the Center of the Sun, shee cannot hide him all wholy, because the Sun shall appeare greater.

Of this that wee haue said, it followeth, that all the Eclipses of the Sun, must of necessitie bee in the coniunction, and the Eclipses of the Moone in the Opposition: whereby is inferred, that the eclipse of the Sun in the death of Christ our Redeemer, was not naturall, but miraculous: forasmuch as then was 15. dayes of the Moone, at which time the Moone is at the full, and farre distant from the Sun, and could not eclipse him. In like manner is to be noted, that to see the Eclipses, they of the Sun must bee in the day, and they of the

Moone

Mone in the night. And whether the Coniunction bee in the night, or the Oppolition in the day, the Aſtronomers make none account.

Chap. IX.
Of Time, and of the Definitions thereof.

Forasmuch as hitherto we haue intreated of the mouings of the Sunne, and of the Mone, and how all mouing is in time, (for that nothing may bee moued in any inſtant or out of time) it ſhall bee conuenient now to declare what thing time is, and into what parts it is deuided.

Time (as ſayth the Philoſopher) is a meaſure of mouing, according to firſt and laſt, or before and after. Although by Accident (as Armandus hath ſubtilly defined) Time may bee a meaſure of reſt or quietneſſe: as meaſures of habites, are meaſures of priuations. Or Time may bee a meaſure of the mouing of the firſt moueable, called Primum mobile, and cauſe of generation thereby, and of corruption by Accident. Time hath the limits, that hath the World, and as the World, ſo is it the cauſe of the mouing of the Heauens, and began when God created the Heauens, and ſhall end when the World ſhall haue an end, as the Holy Schooles of Diuines teach vs. It is aſſigned to bee within the Heauens, forasmuch as without them, is neither Time, nor any naturall place. All the time ſince God created the World, vntil it ſhall haue an end, is called Seculum, (that is) a World, or an age of Time. Albeit the word Seculum in another ſence, may bee extended farther then the durabilitie or continuance of the World, and this in Holy Scripture is called Seculum ſeculi, that is, the World of the World: or Secula ſeculorum, which is as much to meane, as the World of the Worlds to come, which ſignifieth Eternitis, or euerlaſting World without end. Likewiſe alſo, Seculum is taken for the ſpace of an hundred yeares, whereby in olde time certaine playes were called Seculares, becauſe they were celebrated from a

hundred to a hundred yéres. The Pope Paul the Third of that name, commanded them to be celebrated in Rome, in the yére 1536. which was the yére in the which the Seculum ended, and began a new Seculum.

And as in time are diuers mouings, so hath it diuers measures, whereof some are greater, other lesse. The greatest measure of time, is a reuolution of the Heauens, which is slowly moued, and the principall or chiefe of these, is that the Sunne maketh, which we call a yére. The lesse measure, is the mouing of the first moueable, which moueth most swiftly: and this measure wee call a day. And forasmuch as there is variation in the greatest measures, we will in the Chapter following intreate of the yére, and of the diuersitie thereof.

Chap. X.

Of the yeere, and of the diuers beginnings and reckonings, or computation had thereof in olde time.

There are three differēces of the yéres, as the great yére, called Annus magnus, the Solar yeere, and the Lunar yeere. The great yeere is the space of time, in the which all the Planets returne to the place, where they had beene some time before. As if they all had beene in the beginning of Aries, and had begunne their course from thence, and should againe all returne thither, then should be the great yeere.

By the description of other, the great yeere is, when the eighth Sphere ioyntly with all the Auges, make one perfect reuolution at the mouing of the ninth Sphere. And this shall be in the space of 49. thousand yeeres.

The Solar yeere is a reuolution of the Sunne, carried by the proper mouing of his Heauen vpon his Axis and Poles of the Zodiacke, ending where it beganne, and returning another yeere by the selfe same course, as the Poet Virgil affirmeth.

Atque

Atque in ſe ſua per veſtigia voluitur annus.

That is to ſay, the yeere turneth againe to himſelfe by his owne proper ſteps.

The Egyptians lacking the vſe of Letters, and hauing the ſame conſideration, painted the yeere like vnto an Adder, byting her owne tayle: and hereof was a Ring called Annulus, as it were Annus (that is, a yeere) becauſe a Ring turneth round in it ſelfe, as doth the yeere: Of the quantitie of this yeere were diuers opinions and computations among them of ancient time. The Arabians and Perſians accounted it regularly by twelue Mones, which are three hundred, fifty foure dayes. Romulus gaue to his yeere tenne moneths, becauſe that time ſufficeth a woman to bring forth her birth, and alſo for that during ſo much time, it was not lawfull for a Widdow to marrie after the death of her Husband. Numa Pompilius added two months, to make it vp twelue months in 350. dayes, which was the moſt ancient yeere of the Hebrewes, according to the which they account at this day. The Greekes and Egyptians conſidering the courſe of the Sunne, made the yeere of three hundred, ſixtie fiue dayes: then by the commandement of Iulius Cæſar (whoſe order we nowobſerue) were added fiue houres, to the end to make equall this number of dayes with the courſe of the Sunne: and hereof the Biſextile or Leape yeere had his beginning, from foure to foure yeeres. But to ſay the truth, they erred, the one by ſomewhat too much, and the other by ſomewhat too little.

This yeere containeth 365. dayes, 5. houres, and 49. minutes.

Likewiſe at the firſt, the yéere had diuers beginnings: Numa Pompilius began it from the Winter Solſticiall, becauſe that then the Sunne beginneth to riſe towardes vs, as Ouid affirmeth in theſe verſes.

Bruma noui prima eſt, veteriſque nouiſſima Solis,
Principium capiunt Phœbus & Annus idem.

Which may be thus Englished.

Brume is the firſt of the new yeere,
And laſt day of the old:
The Sunne and yeere beginne at once,
As Ouid hath vs told.

Romulus began it at March, at the Equinoctiall of the Spring, becauſe that then all things reuiue and flourish: And by the opinion of the Diuines, it ſeemeth good reaſon to beginne the yeere at March, becauſe the World was created the 25. of the Kalends of April, which is the 18. of the moneth aforeſaid. Likewiſe God ſpeaking of this moneth to the people of Iſrael, ſaid vnto them: This ſhal be ỹ firſt of the months of the yeere. The Arabians beginne from the Summer Solſticiall, whoſe opinion is, that the Sun was made in the Signe of Leo. Other begin the yeere in September, about the Equinoctiall of Autumne, as doe the Iewes, reſting in the authoritie of Geneſis, where it is written thus: Let the Earth bring forth greene hearbs, to haue fruit agreeable to their kind, &c. And becauſe Autumne is a fruitfull time, they began from thence to account their yeere. The Greekes, Perſians, and Egyptians account it from October. The Chriſtians, ſome from the Incarnation of Chriſt, other from his birth, and other from the firſt day of Ianuarie.

In like manner is great diuerſitie in beginning the number of yeeres, which we call æra, that is the date. The Greeks began their date from the death of great Alexander. The Egyptians from the death of Nabuchadnezar. The Perſians from Geſdargit. The Arabians or Moores from ỹ preaching of Machomet, who was after the birth of Chriſt 626. yeeres. Other alſo from the Romane Emperors. The Chriſtians began the account of our Sauiour Jeſus Chriſt 500. yeeres after his birth, as writeth Cardinall Cuſanus. And here it ſhal not bee from my purpoſe, to ſhew how iuſtly and rightfully was commanded by Don Iohn King of Spaine the firſt of that name, that in the Courts and Parliaments, which hee held

in

in Segouia, in the yere 1383. leauing the dates that they had begun from the Emperour Octauian, for Tributes and other payments specified in Writtings and Priuiledges, they should no more put the date of the Emperour, for as much as the day in the which the Sonne of God became man, and was borne by the blessed Virgin, was so excellent a thing, and most worthie to bee had in memorie. So that in Spaine, since that time, in al cõmon Writings, the date is made from the Natiuitie of our Lord, beginning there the first day of the yere, and commonly the first day of Ianuarie: some Astronomers begin it the first of March.

We haue in this Chapter intreated of the great yeere, and of the Solar yere with his quantitie, beginning and date. In the Chapter following, wee will intreate of the Lunar yere, which we call a Moneth.

Chap. XI.
Of the Moneth and of his differences.

COnsidering the Moneth absolutely without hauing respect to the Solar yere, it may bee called a yere according to the diuision we haue made in the Chapter of the yere. For it is a reuolution of the Heauen of the Mone which moueth slowly in comparison of the first heauen. And if wee consider the Moneth as part of the yere, then is the name of a Moneth more proper vnto it. For this word Mensis, in Latine is deriued of Mensura, which signifieth measure. And so the Moneth and yere referred to time, all may bee called Moneth, forasmuch as all is the measure of time, as we haue touched in the said Chapter of the yere.

The Moneth is to bee considered in two manners, eyther (as it is) part of the Solar yere, or is caused by the course of the Mone. The Moneth that is part of the Solar yeere, is that which at this day wee vse. And into twelue of these Moneths is the yeere diuided, as Ianuarie, Februarie, March, April, May, Iune, Iuly, August, September, October, November December.

They are not all of equall dayes. April, Iune, September, and Nouember haue thirtie dayes, all the other haue thirtie one, except Februarie, which hath twentie eight, and when the Biſsextile or Leape yeere is, it hath twentie nine. The names and numbers of theſe Moneths were aſſigned at the will and pleaſure of men, and the cauſe why they haue remained ſo long time, is the authoritie of the Emperours, that ordained them for the common people, who accepted them by the Romane Church, which admitted the vſe of thē.

The Lunar Moneth hath two conſiderations. The one is the time which the Moone tarrieth, from that ſhe commeth forth from one point of the Zodiacke, vntill ſhe returne thither by her proper mouing; and this is called the Moneth of the Peragration, in which reuolution ſhee ſpendeth twentie ſeuen dayes, and almoſt eight houres. The other conſideration is, hauing reſpect to the time which the Moone tarrieth, from that ſhe is in coniunction with the Sun, vntill another coniunction, and this is called the Moneth of Conſecution, and is more then the month of the Peragration, by 2. dayes, foure houres, and 44. minutes: for the Sun and the Moone being in coniunction vnder one point of the Zodiacke, and mouing both by their proper motions toward the Eaſt, as the mouing of the Moone is ſwifter then the mouing of the Sunne, ſhe leaueth him behind.

And when ſhe hath ended her Moneth of Peragration, ſhe returneth to the point from whence ſhee departed, and not finding the Sun there (becauſe in the meane time the Sunne of his proper motion hath gone almoſt 27. degrées) the Moone paſſeth from this point, and in the ſaid two dayes, foure houres, & 44. minutes, ouertaketh the Sun, & ſo commonly hath this Moneth of conſecution, 29. dayes, 12. houres, and 44. minutes: So that whatſoeuer is ſaid of the Lunar Moneth, is to be vnderſtood of this Moneth of Conſecution, which all they vſe that account by Moones: as doe the Hebrewes, Arabians and Perſians.

The Mariners ought not to neglect this Computation, becauſe

because it is conuenient for them to know the Tides, and other Effects, caused by the Aspects of the Sunne and the Moone, for their Aspects doe correspond to the parts of this moneth, as the Coniunction to the beginning, the Oppositi-on to the middest, and the Quartile Aspect to the quarter, and so of the other. Likewise in this moneth, is considered the Illumination of the Moone, and the dayes that the light faileth her: so that neyther by day nor by night we may see her: for being burnt vnder the beames of the Sunne, the time that shee is so, is called Interlunium (that is) the change or hiding, which is sometime more, and sometime lesse. When the Coniunction shall be from the beginning of Capricorne vntill the end of Gemini, and the Moone hath North Latitude, and her mouing swift: then shall the New Moone soone bee seene, and so shall the Interlunium bee but little. And when the Coniunction shall be from the beginning of Cancer, vntill the end of Sagittarius, and the Moone hath South Latitude, and her mouing slow, the longer will it bee or the New Moone shew her selfe to vs, and certaine of the causes concurring, and not all, so shall the Interlunium bee in a meane betweene both. There is also another month, which is called the month of Apparition, which consisteth of 28. dayes, deuided commonly by foure weekes, each weeke containing seuen dayes, for foure times seuen is twentie eight, of which foure weekes the first is counted from the first appearance of the ☽ till the seuenth day, and so forth from weeke to weeke, so as the fourth weeke endeth at the twentie eight, in which account the odde houres during the Moones abode vnder the beames of the ☉. when shee is said to bee combust, are not reckoned.

Chap. XII.
Of the Weeke.

The Weeke is a time of seuen dayes, the beginning whereof is Sunday, and so did the Iewes count their

firſt day, ſaying prima Sabati, ſecunda Sabati, (that is) the firſt of the Sabbath, the ſecond of the Sabbath, &c. to the ſixt of the Sabbath, and then the Sabbath: the Romanes, that called the Planets Gods, forasmuch as the Sunne was principall among them, called their firſt day, the day of the Sun, the ſecond of the Mone, the third of Mars, the fourth of Mercurie, the fift of Iupiter, the ſixt of Venus, the ſeuenth of Saturne. The Chriſtians ſolemnizing the Sunday, began their account from it, as on ſuch a day our Lord was borne, on ſuch a day he roſe: and on ſuch a day he ſent the holy Ghoſt vpon his Apoſtles, &c. they alſo account the dayes of the weeke for Ferias.

Chap. XIII.

Of the Day, and of the Night.

THe Day is of two ſorts, as the naturall day, and the artificiall day: the naturall day, is the ſpace of time, wherein the Sunne is carried by the firſt moueable about the Earth: from the Meridian to the Weſt, and from the Weſt vnder the Earth, comming to the Eaſt, and from thence returning againe to the ſaid Meridian: and in this time hath the Equinoctiall giuen one whole turne and more, ſuch part of it as correſponderh to the proper mouing of the Sunne: or otherwiſe, the naturall day is a Circle deſcribed with the Center of the Sunne, at the mouing of the firſt moueable: the Romanes began this naturall day, from midnight, and ended it in the midnight following, and ſo we account it for faſting dayes, and from euening to euening, in celebrating of Feſtiuall dayes: the Athenienſes began it at the Sun-ſet, or going downe of the Sunne: the Babylonians, at the riſing of the Sunne: the Vmbrians and Ethuſcos, from the midday, or none, and ended it the none day following. In this manner doe the Aſtronomers begin it, and find that the day ſhall euer beginne at one ſelfe ſame houre for the qualitie of the Meridians. And if they had begun it from the riſing or fall of the Sunne,

Sunne, it ſhould not be euer at one ſelfe ſame houre, becauſe the Sunne riſeth and falleth at ſome times ſoner, and at other times later: and ſo ſhould the beginning of the day bee variable: it is to be vnderſtood, that when we commonly ſay, at the tenth Day of ſuch a Moneth, the ſame tenth Day doth end the ſame Day at noone, and the houres that run from that noonetide forward are of the eleuenth day, ſo: and doe the Aſtronomers account them.

The Day artificiall, is a part of the day naturall, and is the time that the Sunne tarrieth from that it ariſeth in the Eaſt, vntill it fall in the Weſt: and the night is that part that lacketh or faileth for the naturall Day, which is the time that the Sunne tarrieth from that hee hideth himſelfe in the Weſt, vntill hee returne to appeare in the Eaſt: and ſo the Day artificiall and the night, make one naturall Day: and according hereunto, it is written in Geneſis, that of Euening and Morning was made one Day. Iſidorus defining this artificiall Day, ſayth, that the Day is the preſence of the Sunne, or the being of the Sunne aboue the Earth: as it is night vnto vs when he is vnder it. Or otherwiſe, the night is the ſhadow of the Earth, extended diametrally oppoſite to the Sunne. The quantitie and differences of theſe dayes artificiall, and their nights, and how they increaſe and diminiſh, we haue largely declared in the firſt Chapter.

Chap. XIIII.
Of Houres.

As there is two differences of the Day, as the naturall Day and artificiall: ſo is there 2. differences of houres, as houres naturall, which correſpond to the naturall Day, and houres artificiall, which correſpond to the artificiall Day: Hora or Ora is a Greeke name, and ſignifieth end. And ſo ſay we Ora Maris, for the end or brimme of the Sea, or the liſt or edge of apparell, as ſayth Iſidore in his Etimologies: the houre naturall or equall, is a 24. part of the Day.

day naturall, and is the time passing fifteene degrées of the Equinoctiall. These 24. howres make one Naturall day. The Astronomers doe beginne the day at the Meridian, counting the houres after the order of the first moueable, which is from the said Meridian, in the Angle of midnight, where they account twelue houres, & from thence towardes the East, and come to end the 24. houres in the same Meridian where they beganne, and this they vse for the computation of the Tables of the mouings of the heauens. The Astronomers vse the same in their Instruments, as in the Astrolaby, and Dials Horizontall, and Verticall, and in all other Instruments for houres. In Spaine also wee vse to account these twenty foure in two times twelue, beginning at noon, and ending at twelue at midnight: and againe, beginning at midnight, and ending other twelue at noone: And to distinct the one from the other, they call the one afternoone houres, and the other forenoone houres, and commonly wee say fiue houres of the morning, and fiue of the euening. In Italy they account them from the falling of the Sunne, vntill the next fall the day following.

The Artificiall or temporall houre, is a twelft part of the day arke, or the night arke.

They are called temporall houres, because they vary in the times that the day varieth: For in the time that the daies shall bee great, so shall the houres: and when the daies shall bee short, so likewise shall the houres bee, and in like manner of the nights: so that as the Artificiall day great or little, is diuided into twelue houres, euen so the night great or little, is diuided into other twelue. The Ancients diuide the day into foure parts, and the night into other foure, giuing vnto euery quarter part three houres. At the rising of the Sunne, which was the first houre of the first quarter, they called the first houre, and three houres passed, they called the third houre, and fiue houres passed of the day, they called the fift houre, which was the midday or noonetide. Also the ninth houre they named at nine houres past of the day. And

the

the Sunne ſet, or going downe of the Sunne, they called the Euening, as ſaith the Poet Virgil in this verſe.

Ante diem clauſam componet veſper Olympo.

And according to this Computation, it is to bee vnderſtood that Saint Matthew writeth: That the Labourers came to the Vineyard at the eleuenth houre: whereby is meant the fift houre, one houre before the Sun was ſet. And when wee read in Saint Iohn, The Ague left him the ſeuenth houre, &c. By this account it was one houre after Noone, when Chriſt healed the Sonne of the Ruler that was diſeaſed in Capernaum. In like manner by theſe houres, the Ancients diuided the Night into foure quarters, giuing three houres to euery quarter: And in theſe foure parts of the night, were Souldiers appointed to watch. In the firſt quarter, which they call Canticinium (and we the firſt ſleep) they watched all: In the ſecond, which they call Intempeſtiuum, being the time of midnight, the young men watched: in the third, which they call Gallicinium, of the crowing of Cockes, watched the Souldiers of middle age: in the fourth and laſt quarter, called Matutinum or Antelucanum (that is, the ſpring of the day) the old Souldiers watched: and thus is vnderſtood, the firſt, the ſecond, and third watch of the Night: in like manner ought the Mariners to keepe watch and ward, to auoid aſwel the peril of the Sea, as alſo the danger of Rouers, and to diuide the night by quarters, after the manner of Souldiers, as did alſo the Mariners in old time.

Chap. XV.

Of the making and vſe of an Vniuerſall Diall for the Day.

VVHereas in the Chapter before, wee haue intreated of houres, and their differences, wee intend heere to deſcribe the making of an Inſtrument generall, to know the

the houres of the Day by the beames of the Sunne, which is done in this manner. Take a round Plate of Latine, and let it be called the Equinoctiall Circle, the Circumference whereof you shall diuide into 24. equall partes, by both the sides, and from the Center to euerie of these parts, you shall draw a right Line: one of the which shall bee a Meridian: and in the one part of that write twelue, which shall bée the houre of the midday or noone: and in the other part, write other 12. which shall be for midnight. In the highest part, turning vpon the Center, toward the right hand, write one, two, three, foure, &c. In the lower or nether part, you shall count toward the left hand, turning it vpon the Center, so that the one houre of the one part, come vpon the Line of the one houre of the other part: in like manner two vpon two, three vpon three, and so forth of the other. And note that in the Line of fire at afternoone, and at the Line of the fire in the Morning there remaine certaine round péces, corners, or ends, after the manner of Aris, of the thickneſſe of the selfe same Plate. Then make a halfe Circle of the same Pettall as bigge as the halfe Circumference of the Plate, and of the thickneſſe of a péce of foure Ryals of Plate, or somewhat more, euen as the Plate it selfe, and of the breadth of halfe a finger, if the Inſtrument shall be great; or lesse, if the Inſtrument shall be lesse. This halfe Circle shall you graduate or diuide into a hundred eightie degrées, beginning at the one end, one, two, three, and so forth vnto ninetie in the middeſt, and the like shall you doe from the other end vnto the same ninetie. Also you muſt number them in the breadth of the same halfe Circle: and this halfe Circle shal you make fast on the nether part of ỹ Inſtrument, so that the ends thereof may be fixed in ỹ ends of the Meridian Line. Then through the Center of the Plate or Equinoctiall Circle, shall passe a round Stéle or Wyer of the same Pettall, made fast or soldered in it, so that it riſe and come forth equally from euery side of the Plate and fourth part of the Diameter of the same, and this shal be called the Aris or Arletrée of the World. The inſtrument

ſtrument being thus made, you ſhall place it, or ſet it in a frame, hauing two Armes, Standards, or Arches, ſo that it change betweene the ſaid Arches, borne vp by the round peeces or ends of the plate, left thereof at the ends of the line of the fiue houres aforeſaid, in ſuch ſort, that being thus ſtayed, it may be directly turned. And in the middeſt betweene theſe two armes, beneath in the fot of them, or where they are placed, you ſhall raiſe a pricke or point, ſo that the plate which ſignifieth the Equinoctiall, being perpendicular, the brimme or edge thereof may fall vpon the point or pricke, and conſequently the plate ſtanding plaine or flat, the ninetie degrées of the halfe Circle muſt ſhew or touch the ſaid pricke, as ſhal alſo the end or extremitie of the Axis of the World, and the other end ſhall ſhew the Zenith or verticall point.

This Inſtrument muſt bee ſo placed, that the Meridian Line be North and South, which you ſhall finde in this manner. In an open and plaine place, where the Sunne ſhineth for the moſt part of the day, you ſhall make a Circle with a paire of Compaſſes, in the middeſt whereof you ſhall ſet a Steele or Wyer ſo vpright that it decline not, or bend not, eyther one way or other, and the ſame no longer then the fourth part of the Diameter of the Circle. Then in the morning when the Sunne riſeth, the ſhadow ſhall bee very long, and as it riſeth higher and higher, ſo the ſhadow waxeth ſhorter and ſhorter. Then muſt you obſerue the time when the extremity or end of the ſhadow toucheth in the Circumference of the Circle, and where it toucheth, you ſhall make a pricke. Then goeth the ſhadow ſhortning vnto the midday or none tide, and as from thence the Sun declineth, ſo doth the ſhadow increaſe, and when it ſhall come againe to the Circumference of the Circle, you ſhall make another pricke. Then ſhall you part in the middeſt, the Arke that is betweene the one pricke and the other, and from the middle pricke, draw a right line to the Center of the Circle, and that ſhall be the Meridian Line, whereupon you ſhall ſet the Inſtrument. Furthermore, in the fot of the frame of the Inſtrument,

ment, you shall set a Compasse or Dyall, which shall shew the Meridian Line. This done vpon the Arches of the frame, and corners of the fiue houres, you shall turne the Equinoctiall, so farre that it passe so much of the halfe Circle by the middle pricke, how many degrées the Pole is rayſed aboue the Horizon of that Region or place where you are, and then the shadow of the Wyer or Stéle shall iustly shew in the Plate, the houre; and what a Clocke it is.

Here

Here followeth the Figure of the Instrument.

Chap. XVI.

Of certaine particular Dials, Murall, and Horizontall.

Among sundry manner and fashions of particular Dials, there are two principall. Whereof the one is Horizontall, which is placed in the Superficies of the Horizon: the other is verticall, and must be made or set on a Wall perpendicular, and directly against the South or Midday, from the true Leuant or East, to the true Ponent or West, the which the Mariners call East and West. To make any of these two Dials, you must draw a right line, and call it the Axis of the Poles of the World, vpon the which you shall draw an halfe Circle, and diuide it in ninetie equall parts. And where the halfe Circle is cut with the Line of the Axis, must be accounted by the Circumference, the Altitude of the Pole for the Citie or place, for the which you intend to make the Diall. And in the point of the Circumference, where endeth the Altitude of the Pole, you shall make a marke, and write there, the Altitude of the Pole: and from that point draw a right line vnto the point where you began to account the Altitude of the Pole, which Line shall bee called the Semidiameter, or halfe Diameter of the verticall Circle. And from the same point of the Altitude of the Pole, draw another right Line to the other extremitie or end of the Axis, and this shall be called the Semidiameter of the Horizon: and likewise from the same point of the Altitude of the Pole, draw a right Line perpendicular, vntill it touch in the Axis, and this shall be called the Semidiameter of the Equinoctiall. Hereby is considered a Triangle, which hath by the sides thereof the Semidiameter of the verticall, the Semidiameter of the Horizon, and the Axis of the World; which Triangle shall serue afterward. These three Semidiameters of the verticall, the Equinoctiall and the Horizon being found, you shall make the Diall in this manner.

Draw

Draw a right Line ſomewhat long, and call it the Line of Contingence. This ſhall you cut with another Line in right Angles, after the manner of a Croſſe, which ſhall bee the Meridian Line. Then with your Compaſſe, take from the Triangle the Semidiameter of the Equinoctiall, and of this bigneſſe draw a Circle vpon the Meridian Line, ſo that the edge or brimme of the Circle touch in the Line of Contingence, then with a Compaſſe take the Diameter of the Verticall Circle, if you will make a Murall Dyall, or the Semidiameter of the Horizon, if you will make a Horizontall Dyall, on a plaine or flat forme. Therefore with ſuch Semidiameter as you deſire, you ſhall draw a Circle vpon the other part of the Meridian Line, ſo that the Circumference thereof touch in the Line of Contingence, then ſhall you diuide the Equinoctiall Circle into foure equall parts, and the quarter that is toward the Line of Contingence, ſhall you diuide into fiue equall parts. And ſetting the end of the Ruler in the Center of the Equinoctiall, and vpon euery point of them that diuide the fiue equall partes, from thence ſhall you draw certaine right Lines, vntil they touch in the Line of Contingence. And from theſe points of the Line of Contingence, you ſhall draw other right Lines, to the center of the Horizontall Circle, which Lines ſhall bee the determiners of the houres. And neere vnto the Meridian Line, where it toucheth in the Line of Contingence, you ſhal write twelue, and conſequently toward the Eaſt you ſhall write, one, two, three, foure, fiue, ſixe, and from the firſt houre, you ſhall draw a right Line, which ſhall paſſe by the Center of the Horizontall Circle, equally diſtant from the Line of Contingence. The one quarter of the Horizontall being drawne by the ſelfe ſame, and of the ſame meaſure and bigneſſe ſhall you draw the other, in ſuch ſort that the ſame bigneſſe, that is from twelue to one, the ſelfe ſame ſhall you giue from the twelfth to the eleuenth, and the ſame bigneſſe and meaſure that is from one to two, ſhall you giue from eleuen to tenne, and ſo forth of the other.

And note that the Horizontall Dyall after the firſt houre of the Euening, ſhall haue the houres of ſeuen and eight, and in Climates farre North, 9. alſo, and more if need ſhall require, and conſequently they muſt haue the houres of fiue and foure of the Morning, and in Climates farre North, three alſo: and theſe muſt be ſo marked, that from fiue to ſeuen may bee the ſame that is from foure to fiue: alſo foure and fiue of the Morning, as ſeuen and eight. The Dyall being thus drawne in paper, or on a Table, or any other thing, muſt be painted (on a Table, or in Stone, or in whatſoeuer you deſire to make the Dyall) a Circle of the ſame bignes as is the Circle Horizontall, and in that muſt be tranſlated the Lines and Numbers of the ſaid Circle Horizontall. Then muſt you make a Triangle of Mettall, of the ſelfe ſame bignes and forme that is made in the middle Circle: and the ſide of this Triangle (which is called the halfe Diameter of the Horizon) muſt be fixed vpon the Meridian Line of the Horizon Dyall, ſo that the ſide of the Triangle (which is the Axis of the World) and extremitie or end thereof, may fall in the Center of the Horizontall Dyall, and muſt ſtand ſo perpendicular, that it decline neyther to the one part nor to the other. The Dyall being thus made, you ſhall ſet it vpon a Meridian Line, ſo that the Meridian Line of the Dyall may ſtand or reſt vpon it, and ſo ſhall the ſhadow of the Triangle ſhew the houre: and if for this place we deſire to know it, we muſt fix it there, and if for any other place, ſo ſetting it, wee ſhall haue a certaine houre: ſo may we in any inſtant remoue it to another place, and likewiſe ſet it there to make certaine and true demonſtration of the houre.

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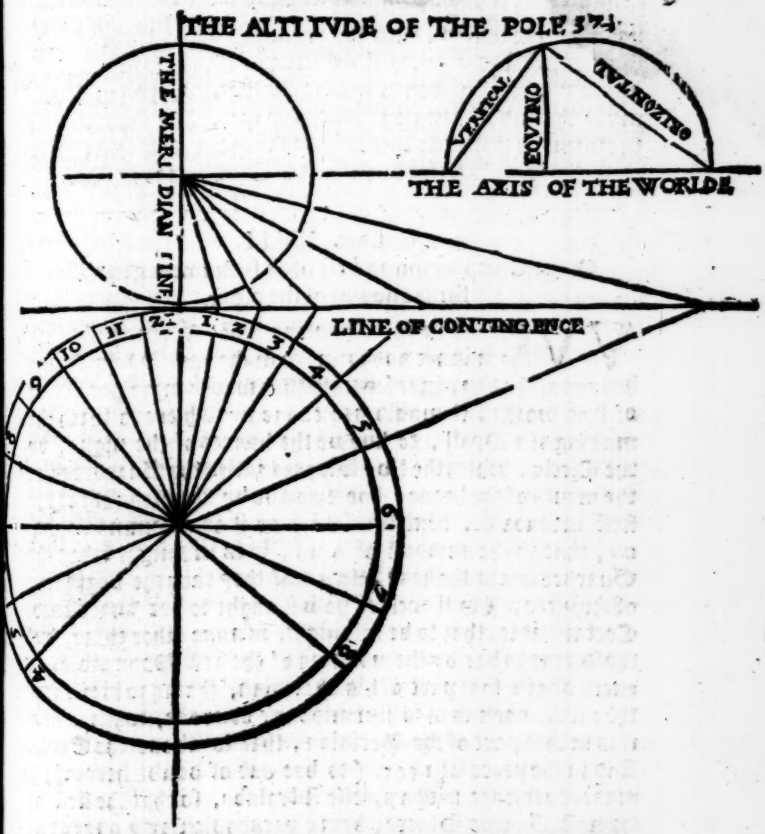
Here followeth the Figure of this Demonstration.



In like manner as is made the Horizontall Dyall, must be made the verticall, taking from the Triangle the Semidiameter of the Circle verticall.

And note, that for the Circle Verticall, it shall not be needfull of more then fiue houres before noone, and other fiue after noon. And the Triangle must be set in the Meridian Line, vpon the fiue that is called the Semidiameter of the Circle Verticall. And if you will not make a Triangle of mettall, but that a wyre of iron may giue the shadow, then must you make the said Triangle of paste or paper. And according to the forme or patterne thereof, make the wyre of iron, and cause the same to be set in all sorts of Dyals, as is before.

Chap. XVII.

Of the Composition and vse of an Instrument generall for the houres of the night.

VVHereas in the Chapters past, I haue described the manner and forme to make two Dyals for the houres of the day, mee seemeth that for the more perfection of this worke, it would bee conuenient here to teach the making of a Dyall, to know the houres of the night, by the Circle, which the two Starres called the Guardians, or the mouth of the horne, doe describe by the mouing of the first mooueable. But forasmuch as it is a common opinion, that in the middest of April, it is midnight when the Guardes bee in the head, whereof they take the beginning of the yere, I will declare how it ought to bee vnderstood. Certaine it is, that to be midnight, is none other thing, but the Sunne to bee by the mouing of the first Mooueable, to euery one in that part of his Meridian, that is to him vnder the earth, euen as is to him midday, or noone, when to him it is in that part of the Meridian, that is aboue the Earth. And in the yeere of 1545. (to bee out of doubt hereof) I made experience with a precise Astrolaby, so that the first or formost Guarde Starre, being perpendicularly ouer or aboue the North-starre, I found in the Meridian, where the Sunne maketh midnight, the ninth degree of Taurus, whereby it followeth, that the Sunne being in this degree, which

is

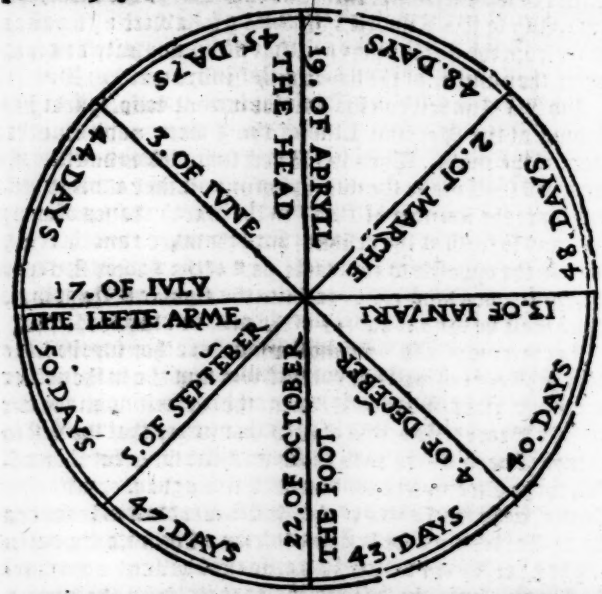
is at the 19. of April, the same Guarde starre shall be perpendicularly ouer the North starre, which is the line of the head, and consequently, the Sun being in the ninth degree of Scorpio, which is at the 22. of October, the Guarde starre shall be in the Line of the feet, and by this calculation may be knowen when it shall bee in the right or in the left, and in all other Lines: so that they manifestly erre, that account the midnight at the 15. of April, when the first Guarde starre is in the Line of the head, accounting a Merce or third part of an houre sooner and more then they should doe.

Hauing thus giuen principles for the Instrument, you shall proceed in the making thereof, as followeth: In paste or on a plate of Latine, make a Circle of the quantity of a span, or of the bignesse that you desire the Instrument or Dyall to be: then make an other Circle somewhat lesse, so farre distant from the greater, that betweene the one and the other may be a space, in the which may bee signed or marked the dayes and moneths. Likewise shall you make another lesse Circle, leauing spare to set the numbers of the dayes of euery moneth. And vnder this Circle shall you make another, leauing space to write the names of the moneths: then shall you diuide the first and greatest Circle into eight equall parts, so that the nineteenth of April may bee in the highest or vppermost part of the instrument, which is where they say the Line of the head to be, and the 22. of October must be in the nether part. Also the 13. of Ianuarie in the right arme, and in the left arme, the 17. of July, and so the other dayes that doe fall to the other Lines, according as they answere to the right ascension of the Sun, as you may see in this figure.

This being thus diuided, you must also diuide the spaces that are betweene the one Line and the other, into the daies which be numbred in euery space, so that betweene the nineteenth of April, and the third of Iune, are fortie fiue daies: and that space shall you diuide into fortie fiue parts: and whereas the Instrument being small, it cannot in so little space receiue so many partes, you shall diuide it from fiue, to fiue

parts, and so shall you diuide the other spaces by the numbers that are signed in them.

Then one day more before the 2. toward the left hand, you shall make a strike, and there shall be the twentieth of April. And fiue dayes more before, make another strike, and there shall bee the twentie fiue. And yet other fiue dayes more before, which shal be the thirtieth of April, make another strike ouerthwart vnto the nethermost Circle, and there shall May begin: and from these dayes shall you beginne to account the dayes of May from fiue to fiue. And in the last space you shal put 6. which shall make the 30. dayes that May hath.



And there shall you make another strike, which shall trauerse ouerthwart vnto the leste Circle. And in this manner you shal diuide the other moneths, giuing vnto euery of them the number of his dayes.

This

This being done, vpon the outward part of the great Circle, you ſhall cut downe the paper paſte, or plate of Latine, leauing of the ſame for a ſigne or marke, a flower deluce vpon the 19. of April, for that it muſt bee the head, and likewiſe at the 22. of October, may be left a hold to handle it by. Then muſt you make a Rundell to the ſame paſte or Latine, of the bigneſſe of the leſſe Circle, without the Circumference whereof, ſhall be left a toth or Inder, in the which you ſhall write, Time. And from the one ſide of this Inder towardes the left hand, you ſhall draw a right Line that may paſſe through the Center to the Circumference, and this ſhall be the Meridian Line. Alſo to this Rundell you ſhall giue a Circle, ſo much lower from the Circumference, that there may be left a ſpace where the number of the dayes may be written.

And this Rundell you ſhall diuide into 24. equall parts, beginning at the Meridian Line of the Inder, at the twelfth houre of the night. Then in the next ſpace towardes the left hand, you ſhall make the number of one. Likewiſe in the ſecond ſpace the number of two, in the third, the number of three, and ſo forth at the reſidue, vnto the other twelue of the day, in the oppoſite or contrarie part of the Inder. So conſequently proceeding 1. 2. 3. &c. vnto the twelue of the Inder, which ſhall be the 24. houres of the naturall day.

Furthermore alſo you muſt make another peece of the ſame ſubſtance of paſte or Mettall in manner of a horne, in forme and order as are in Heauen, the 7. ſtars, which make the leſſe Beare: And this of ſuch quantitie, that the firſt or formoſt Guard ſtarre may reach without the great Rundell cloſe to the Circumference thereof, hauing the North ſtar his Center, with the Center of the Inſtrument. And from this ſtar or Center vnto the firſt and formoſt Guard ſtar muſt be a right Line, by the which the horne muſt bee cut neere from the Center, vnto the diſcouering or ſhewing of the houres. Alſo from the firſt Guard to the ſecond, muſt be two parts of nine, of that that is from the ſtar, which ſignifieth the North to the firſt Guard. Againe, the ſecond and laſt Guard muſt

be toward the left hand, ouer or aboue the first, three quarter parts of one halfe Circle, which hath for the Semidiameter the two parts of nine (whereof we haue spoken before) giuen vpon the right Line that goeth from the North to the first Guard. These two Guard starres must bee boared through with holes, of the bignesse of an Agglet of a point, and likewise the North starre, also with the two rundels through the Center, and by that, all 3. peeces annexed, so that there remain a hole in the middest, like the holes of the Guards, so that by it, and by the other of the Guardes, may bee seene the starres in Heauen, in such sort, that the lesse Rundell and the horne may be turned round about the Aris, as doth appeare in the demonstration following. This Instrument described as before is said by Martin Curtis, is necessarie, saue onely that I think it better to place the perpendicular of it the vpper part thereof, on the 25. of April, at which time the foremost Guard in these times is precisely vpon the Verdian, aboue the Pole iust at 12. a clocke at night, and the lower part of the said Diametrall perpendicular, to extend to the 28. of October, and being so accommodated, you may with much facilitie vse it after the manner as is after declared.

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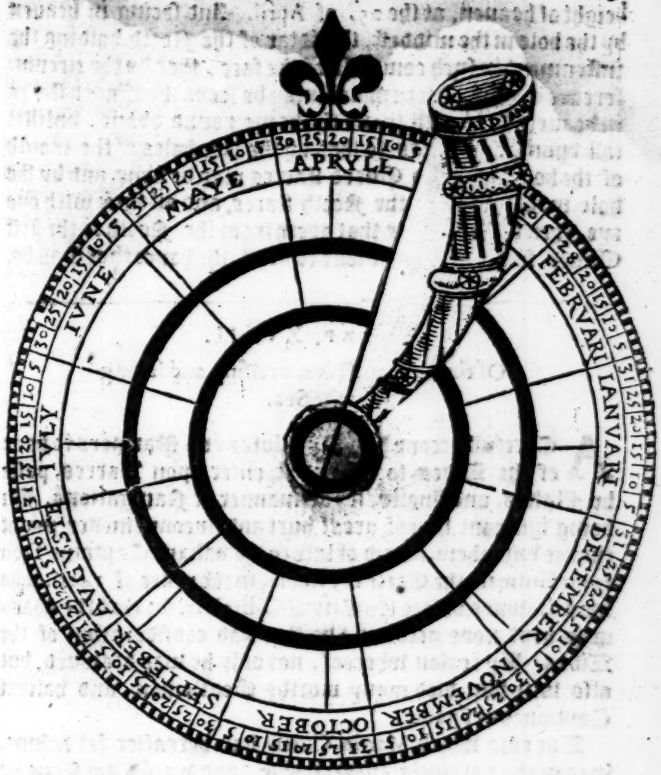


This Instrument thus ended, and brought to perfection, when you desire to know the houre, you shall turne the Inder of the lesse rundell, in the which is written Time, to that part of the great rundell, where is marked the day in the which you desire to know the houre, and directing your face toward the North, you shall make the head toward the height

G.Beg.

height of heauen, at the 25. of April. And seeing in heauen by the hole in the middeſt, the Starre of the Northe, holding the inſtrument in ſuch compaſſe of the face, that by the circumference of the greater rundell, may be ſeene the Guard ſtarre in heauen, you ſhall turne the horne round about, vntill it fall vpon the Guards, ſo that by the two holes of the mouth of the horne, the two Guard ſtarres may be ſéne, and by the hole in the middeſt, the Northe ſtarre, and all three with one eye, then the right line that goeth from the Northe to the firſt Guard, ſhall ſhew in the leſſe rundell, the houre that ſhall be.

Chap. XVIII.

Of the time of Tides, or riſing and falling of the Sea.

A Carefull account ought Pilotes and Mariners to haue of the Tides, to take Port, enter vpon Barres, paſſe by Flattes, and finally, for all manner of Nauigations. For being ignorant hereof, great hurt and inconuenience might chance vnto them, as did of late to the valiant Captaine, Don Iohn Guſman, the Egrle of Niebla, in the yeare of 1436. who was drowned before the City of Gibraltar, for that the Mariners kept none account, neither had conſideration of the Tides. By reaſon whereof, not only he was drowned, but alſo with him died many worthy Gentlemen, and valiant Captaines of Spaine.

The rule which Martin Curtis had hereafter ſet downe, was made particularly for Spaine, and would not ſerue for any place, but only where a North-Eaſt, or South-Weſt Mone makes a full ſea: And therefore in ſtead thereof I haue here ſet downe a generall rule for any point of the compaſſe whatſoeuer, by which rule as alſo by the Inſtrument to that purpoſe following, knowing the age of the Mone, & what Mone makes a full Sea, the Tides are found to the very houre and minute ouer al the world, as followeth:

firſt

firſt therefore to finde it the Arithmeticall way, doe thus.

If you deſire to know at what houre is Tide or high water, in any particular place, learne by ſome Table, or elſe by ſome expert Mariner, what Moone makes a full Sea thereat, as alſo the houre appropriate to the ſaid point of the Compaſſe: which done, multiply the age of the Moone by 4. divide the product by 5. and to the quotient, adde the houre which makes full Sea in that place upon the change day: if it exceede 12. caſt away 12. ſo often as you may, then the houre of the full Sea remaineth, and to every unity that remaineth upon your Diviſion, allow 12. minutes, which adde to the houres, as if there remaine 1. adde 12.'. if 2. adde 24.'. and if 3. adde 36.'. as for example. The Moone being 12. dayes old, I deſire to know, at what houre it is high water at London Bridge: firſt, I conſider that a Southweſt, or Northeaſt Moone makes a hie water thereat, and 3. of the clocke is the houre appropriate to the point aforeſaid: then according to the former rule, I multiply the age of the Moon, which is 12. by 4. and it makes 48. then I divide 48. by 5. and the quotient is 9. and 3. remaineth, which added to 3. makes 12. houres, 36.'. therfore I conclude that the Moone 12. daies old, the Tide is at 12. of the clocke and 36.'. at London Bridge, or in any place, where the like Moone makes full Sea. Againe, at Erith, a Weſt, South-weſt, or an Eaſt, North-Eaſt Moone makes full Sea, and the houre appropriate is 4. houres, 30.'. the Moone 26. dayes old, I deſire to know the houre of the ful Sea: firſt I multiply 26. the age of the Moone, by 4. makes 104. which divided by 5. the quotient is 20. and 4. remaineth which is added to 4½. the houre when the Sunne is upon the ſaid point of the Compaſſe, & it makes 25. houres 18.'. from which I take away 24. which is 2. times 12. and there reſteth one houre, 18.'.

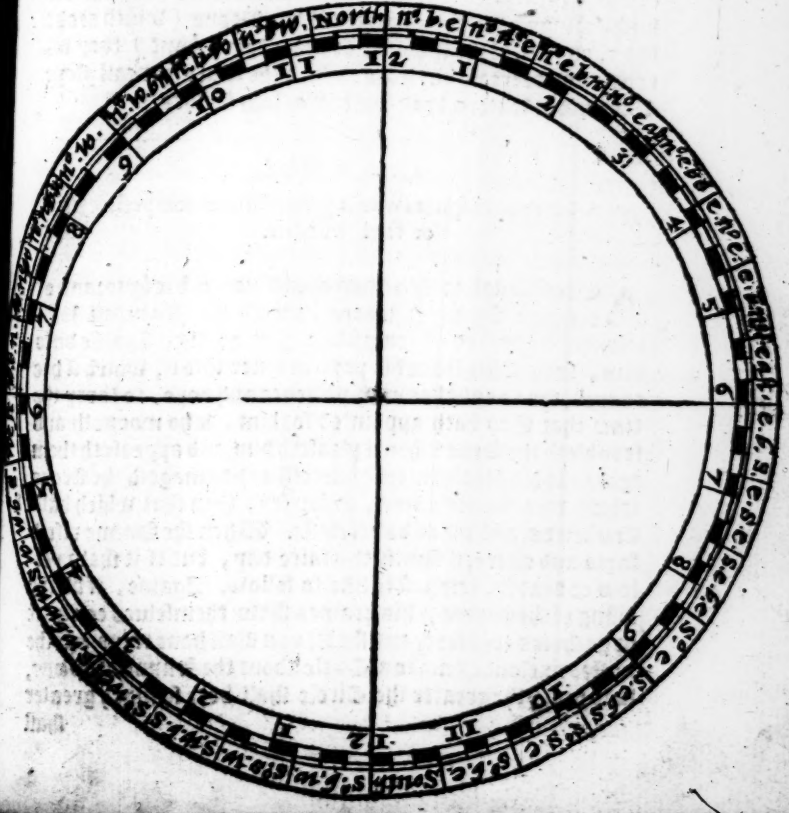
And the better to underſtand the increaſing and decreaſing of the Ocean Sea, it ſhal bee conuenient to know the cauſe thereof, whereunto wee ſay, that the Moone is the cauſe of ebbing and flowing, or riſing and falling, increaſe or decreaſe

decreale of the Sea: not onely by her light, but alſo by her ſecret or hid property. The Moone compaſſeth about the earth, from the Eaſt into the Weſt, vntill ſhee returne to the place or point from whence ſhee departed, and in this courſe wafteth or ſpendeth ſo much more then one Naturall day, in how much her proper mouing is more then the Sunne againſt the firſt mooueable, ſo that ſhee maketh her turne or courſe about the foure quarters of heauen, in 24. houres, and foure fifths of one houre, which are the 12. degrees that ſhee goeth more then the Sunne. And in this time the Ocean increaſeth and decreaſeth twice, ſo that this increaſing and decreaſing anſwereth directly to the courſe of the Moone, whereby it followeth, that the Sea increaſeth fiue houres and one fift part, & decreaſeth other fiue houres and one fifth. And if this day at the twelfth houre, was full Sea, the low water ſhal be at the firſt houre and one fift part: and at the twelfth houre, and two fift parts it ſhall returne to be full Sea, and at the firſt houre and three fifths ſhall be low water againe, and at the twelfth and foure fifths of the other day ſhall be full Sea: ſo that from one day to another the Tide doth ſhorten foure fifths of an houre, which is the time that the Moone lacketh, or tarrieth more then one naturall day, to returne to the point from whence ſhee departed by the twelue degrees, whereof wee haue ſpoken. Whereby it manifeſtly appeareth, how they beguile themſelues, that ſay, that the Sea increaſeth fiue houres, and decreaſeth other fiue. For if it were ſo, the Tides ſhould euer bee at one ſelfe ſame time and houre: but forasmuch as there is more then 24. houres by the ſaid 4. fifth parts, thereby is cauſed the variation of the Tides, ſo that if this day, the Tide bee at one of the clocke, to morrow it ſhall be at one and 4. fifth partes, and the day following, at two of the clocke and three fifths.

The Inſtrument following ſheweth what houre is appropriate to any point of the compaſſe, and the time of high water very readily, the vſe whereof is as followeth: knowing what Moone makes a ful Sea, bring the number of the Moons

age

age in the moueable Circle, to the same point of the Compasse, and staying it there, the houre that Index then cuts, is the time desired. As for example, Being in London where a South-west, or a North-east Moone makes high water, and the Moone five dayes old, I desire to know at what time it is full Sea the same day: first I bring 6. the Non of the Moones age, to the South-west point of the Compasse, and then I finde that the Index of the Druts the houre of 7. and 48'. which is the time proposed.



Againe, being at Graues-end, where a South, South west Moone makes a full Sea, and the Moone 18. dayes old: to finde the houre of the Tide, I bring 18. the Moones age, to the South South west point, and then the Index of the Cuts almost 4. of the clocke, at which time is the tide or high water at Graues-end, vpon the day proposed.

This increasing and decreasing of the Tides, is not euer in equall quantity. In the Coniunctions and Oppositions, they increase and decrease much, which the Mariners call high spring-Tides, and the greatest of all, they call the high-springs. In the quarters of the Moone (which are at the 7. and 22. of the Moone, or neere thereabout) they increase and decrease but little: which the Mariners call Neape Tides, low waters, dead waters, or low floudes.

Chap. XIX.

Of certaine Signes, which prognosticate tempests, or faire weather.

A Good Pilot or Mariner ought not to bee ignorant of certaine signes or tokens, which the Naturall Philosopher described of tempests: For as they signifie vnto him, so shall hee leaue his port, or enter into it, which if hee cannot, then ought hee with patience and hope, to tarry the time that God hath appointed for him, who mooueth and troubleth the Seas when it pleaseth him, and appeaseth them againe at his pleasure: lesse hurteth and damageth the stroke which wee see comming, or foresee, then that which hath stricken vs, and taken vs careleste. When the Sunne riseth fayre and cleere, it signifieth a faire day, but if it shew yellow or deadly, tempest is like to follow. Againe, if at the rising of the Sunne, his beames shew themselues contract or gathered together, and short, you shall haue raine: if the misses or cloudes make a Circle about the Sunne or Moone, how much the greater the Circle shall bee, so much greater shall

ſhall be the tempeſt to come, and if there ſhal be two Circles, the tempeſt ſhall increaſe the more. And if it chance, that at the riſing of the Sunne the cloudes be turned red, it is a ſigne of no ſmall tempeſt. When the Sunne or the Moone ſhall haue a Circle, loke toward the part where it breaketh, and from thence ſhall winde come, if it depart, or diſperſe equally, faire weather ſhall follow. When the Mone riſeth bright, and ſhining with pure colour, you may iudge it faire weather: and if red, winde, if blacke, raine. When in the new Moone, the hornes or corners appeare groſſe or great, it is a token of tempeſt, and if ſharpe, it ſignifieth faire weather.

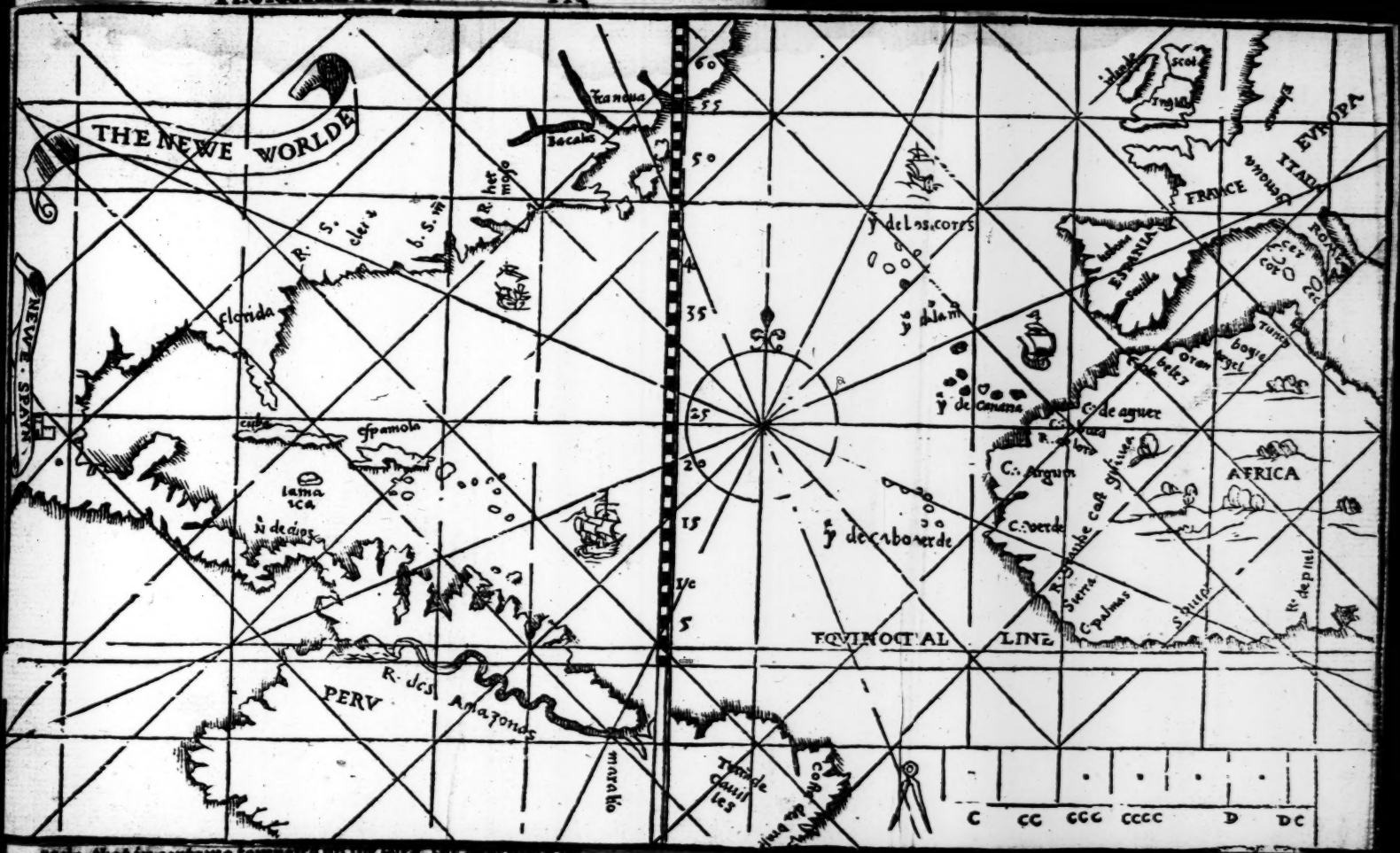
This that wee haue ſaid, is the authority of Plinie, and Ariſtotle, to whom the prudent Mariner ſhall giue credit, vntill hee haue found other more certaine, eyther by his owne experience, or by the experiences of other Wiſe men, worthy to bee beléeued. And euery man ought to trauaile as much as in him is, for the knowledge of theſe things, according as God hath giuen him vnderſtanding and reaſon to appoint the ſame; and this ſhall bee wiſedome, bearing in memory the experience of things paſt, to gouerne preſently, and to prouide for things to come. The prouidence of God is ſo great, that depriuing brute beaſts of reaſon and vnderſtanding, he hath giuen them ſenſe and naturall inſtinct, whereby they may know that, that men doe vnderſtand by reaſon.

By this ſenſe and ſecret Inſtinct of Nature, the Ants or Pilmires, with prouidence and diligence, lay vp in ſtore their prouiſion and Egges, when before they féele the raine to come. The Swallowes alſo when they féele the Winter comming, paſſe the Seas. Likewiſe the Fiſhes when they perceiue ſtormes to come, goe downe to the bottome of the water, and hide them in the mudde of the Sea. And although it may ſéeme beſide my profeſſion, to meddle with matters pertaining to Diuines, yet wil not I omit to ſpeake that Chriſt our Lord ſaith, as teſtifieth Saint Matthew. When the Phariſes with the Sadducees (to tempt him) wil-

ked

led him to shew them signes from Heauen, hee answered, saying, When it is Euening, you say, it shall bee faire weather, because the Heauen is red, and in the Morning you say it shall be a tempest, when yee see that the Heauen drayeth toward redde, &c. They knew by that they iudged of Heauen to determine of things to come, as whether it were euill to take iourney, to enter the Sea, to reape Corne, to lay it abroad, or to gather it in. I say, that to vnderstand the reason that moued them to haue such consideration of time, (which wee now like wise obserue) it is necessary to know that the red colour which appeareth in the Euening, signifieth the drinesse of the ayre, whereby the matter of the grosse vapours which should bee conuerted into the Water, is so much dried, that it appeareth in manner inflamed, and is therefore red, and so is it not aptly disposed to bee conuerted into water, and is therefore the neerest signe of fayre Weather. The other signe, when the heauen in the morning drayeth toward rednesse (yet not redde) sheweth manifestly, that raine shall follow. Whereof the cause is, that this matter is ingrossed, because this Colour cannot bee but in grosse and thicke matter, which is not dried, and therefore is not red, as the cloudes that appeare in the West, in the time of fayre Weather: but it is a matter somewhat troubled, and partly red, and is therefore a confounded matter, which touched with the heate of the Sunne, and therewith broken and dispersed, falleth downe, and is conuerted into water. And further, as touching the said troubled or grosse water, I say, that the dry and ruddy part thereof, is eyther turned into winde by drinesse, or else being compassed about, and inclosed with moyst matter, is altogether conuerted into raine, and so maketh tempest. For by tempest is meant not only raine, but also tempestuous windes with water.

Likewise it is written by Saint Luke: When you see a cloud rise in the West, you say, raine shall follow, and when the winde blowe th South, you say it will bee hote, &c. To vnderstand this, I say, the cause of this is, that raine is made



racle, that in certaine tempests on the Sea, ...
certaine shining and bright fires, which with great superstition

the winde bloweth South, you say it will bee hote, &c. To
understand this, I say, the cause of this is, that raine is made

or ingendred of moiſt vapours, which both may be and are ingroſſed: or otherwiſe, a cloud is a groſſe body of moiſt vapors, ſo ingroſſed, and when the cloud doth ſo riſe, it ſhall bee a ſigne that raine ſhall ſhortly follow, for that that was ingroſſed in the cloud, ſhall ſone be reſolued into water. To the other reaſon, why then ſay, that whē the wind bloweth South, it will be hot: I ſay that that wind is hot and drie. Furthermore it is to be conſidered, that the windes are ſometimes drie, and ſometimes moyſt, yet not by their owne propertie, but according to the Regions by the which they paſſe. Wee ſée that in ſome one Region it raineth with one wind, and the ſelfe ſame wind in other places diſperſeth the cloudes. The Northweſt wind is drie in Spaine, yet in Libia it is very moiſt and raynie. The Southwind in Europe, cauſeth raine in moſt places, and therefore the Poets named it the wind of waters, and this wind in Paleſtina or Iurie is drie. The cauſe of this diuerſitie is, that when the wind bloweth in Paleſtina, it paſſeth by hot and drie Regions, as by the Deſarts of Affrica, and paſſeth not by any Sea at all. But when it bloweth in thoſe parts of Europe, it muſt of neceſſitie paſſe by, & ouer the waters of the Sea Mediterraneum, or the Leuant Sea, where it gathereth moyſture, and cauſeth raine. The Leuant or Eaſt wind in Malaga and Gibralter is moyſt, and in Sneres De La Frontera, is hot as Hell.

Chap. XX.

Of the bright and ſhining exhalations that appeare in the tempeſts, which the Mariners call Santelmo, or Corpus Sancti.

Ignorance is the mother of errors, and therefore will I not omit to ſhew the naturall cauſe hereof, although among certaine ſimple and ignorant people, it is accounted for a miracle, that in certaine tempeſts on the Sea, the Mariners ſée certaine ſhining and bright fires, which with great ſuperſti-

tion they kneele downe vnto, and pray vnto, affirming that it is Sanctelmo that appeareth vnto them, and not contented herewith, some sweare that they haue seene drops of greene wax fall downe. Other affirme, that this wax is of such heat, that if it fall from the top of the Ship, it doth melt the Rozen and pitch of the hatches of the Ship, with such other foolish imaginations: and therefore it shall bee good briefly to speake hereof, to stop the mouthes of such fond and ignorant persons. The exhalations or vapors of the grosse fumes or smokes that rise from the Earth, are constrained or gathered together by the colonesse of the night, and the Ayre, thickned in the first Region of the Ayre, next vnto the Earth. This may and is wont to be inflamed or kindled, and if it find a bodie whereunto it may cleaue, it abideth in that vntill it bee consumed. This fire is cleere and shineth, and yet burneth not. The Greekes call it Polyduces, and the Latines call it Castor and Pollux. It is accustomed to appeare vpon the shrowdes, and oftentimes is seene vpon the pikes of Souldiers, in the Armies of men of war, as Plinie writeth, and this aswell by reason of continuall smoke, as also by the heat of much people. Certaine it is, that smoke is none other thing then fire dispersed, as flame is an exhalation or euaporation that riseth in manner of smoke, from a grosse or fat body, and at the time that it riseth being gathered together, is constrained into flame, inuestured with fire. This resplendence or shining, is also oftentimes seene, not onely in tourneying by Land, but but also in sayling by Riuers, and when it appeareth on the Land, it riseth of the smoke that is gathered together with the cold Ayre of the night, and on the bankes of Riuers: this smoke is gathered of the exhalations of the Water, and consequently, being kindled, appeareth bright and shining. But now let vs come to the Ships that sayle by the Sea, and to the Mariners that are accustomed to tempests: To them therefore (I say) that that light or such other lights as they see, is ingendred of the fumes and smokes of their Ship with the heate of men couched close and neere together in a narrow

place,

place, and when a tempeſt riſeth, the ſaid ſmoke is thickned, preſt together, and beaten downe by the winds in ſuch ſort, that being toſſed from one ſide to another, it is ſet on fire by moving, and taketh hold ſometime on the ſhrowds, and ſometimes on the top, and ſometime alſo in the Poupe, or in the foreſhip: ſo that to ſee this light, or the ſame to appeare, is a naturall thing, and not ſupernaturall.

When Captaine Bezerra was at Coron in the Emperors Nauie, with his Company of Souldiers, he chanced to be in a tempeſt, and ſaw the ſaid fire of Santelmo, which ſhortly after deſcended ſo low, that the Captaine might eaſily come to it, and taking it in his Cloke, he found it to be a little drop of Water. Some haue thought it to be a certaine ſhining Flie, called Taros, which the Sea-men ſometime ſee in a calme in the Summer ſeaſon: and thus Santelmo appeared no more. The Captaine remained aſtoniſhed at the mockerie, and the other perceiued it to be no miracle. The opinion of the Mariners that affirmed it to be Santelmo, may riſe of Saint Eraſmo, Biſhop of Naples (who as they ſay) not onely in his life time, but alſo after his death, was a Patrone and helper of Mariners, that called vpon him in tempeſts. This name of Eraſmo, they of Naples call Ereemo: and proceſſe of time taking away one e by the Figure of Syncope, remained the name of Santermo. And the Spaniards, who neuer can long kép any ſtrange vocable, call it Santelmo, turning r into l. Yet of this Santelmo, whereof the Mariners ſpeake, there is neyther Scripture that maketh mention, nor authoritie that confirmeth it. I heare ſay, that the Fryer Preachers had a religious man of cõmendable life, and good converſation, named Fryer Pero Gonzales, borne in Galizia, and that in his life time, our Lord did certaine miracles by him, and that this is hee that ſhineth and giueth light in tempeſts. No doubt but God worketh miracles in his Saints, and by his Saints, as ſayth Dauid. But if this ſeruant of God, was Pero Gonzales, how then ſhall hee bee Santelmo? Another difficultie there is, as touching this light: for there

are Writings of more Antiquitie then the Law of grace and comming of Christ in flesh, which giue testimonie hereof. For the Poet Virgil in the second of his Æneidos writeth, that this fire appeared vpon the head of Iulius Ascanius: And Titus Liuius in his first Booke, affirmeth, that it appeared vpon the head of Seruius Tullius, the first King of the Romanes.

Pomponius Atticus sayth, that Rome began to bee builded in the third yéere of the third Olimpiades, that is, in the tenth yéere of Ionathan King of the Iewes, and from the Creation of the World 3201. yéres, and 729. yéres before Christ our Sauiour was borne. The Kings of Rome were seuen, and raigned 244. yéres. Eusebius sayth, they raigned 246. Seruius Tullius raigned 44. yéres. Tarquinius Superbus 25. yéres after him. So that discounting these yéres, it shall appeare clearely as I say. Although the yéres were not discounted, let them read Diodorus Siculus, an ancient Writer, let them read Plutarchus, Aristotle, and other old Authors that haue written hereof, and they shall find, that if tempests bee néere vnto the Sea, these fires and lights appeare in them, and appeared not onely to the Gentiles, but at this day also appeare to the Turkes and Moores in tempests: when onely one light appeareth, it is taken for an euill signe: And hereof said Propertius thus:

Candida fœlici soluite vela toro.

And why it is an euill signe, this is the cause, that if the tempest that riseth be great, it choketh the exhalatiõ, although yet by the part left troubled, it appeareth. When there are two lights, it signifieth that it is sufficient to consume the matter of the tempest, or that the tempest beginneth to cease, and the grosse humor hath the Mastery. But sometimes it chanceth that two lights appearing, there may be a tempest, and one appearing shal not be so great, and oftentimes there is a tempest without any light at all séene. The blind Gentilitie called these Castor and Pollux, and placed them in Heauen in the Signe of Gemini.

Now

Now remaineth to anſwere to one obiection of the Mariners, who ſay that neuer man that hath ſéene theſe fires hath periſhed. To this I ſay, that many may ſée, and haue ſéene theſe lights, of whom ſome haue bin in perill, and ſome drowned: Notwithſtanding, no man can affirme, that if the drowned might ſpeake, they would ſay that they haue ſéene them. Therefore the wiſe Chriſtian Mariner ought to haue a cleere conſcience, and to call for the helpe of Almightie God, lifting vp his eyes and hands vnto Heauen, and ſay with the Prophet, Saluum me fac, Deus, quoniam intrauerunt aquæ vſque ad Animam meam: Saue me, O my God, for waters haue entred euen vnto my Soule.

Here endeth the ſecond Part.

THE THIRD PART, ENTREATING OF THE COMPOSITION AND VSE OF INSTRVMENTS, AND RVLES FOR the Art of Nauigation.

CHAP. I.

Of the Number, Order, and Names of the Windes.

EOLVS King of the Eolus Ilands or Ilands of Vulcan, was so greatly esteemed for hauing reason and knowledge of the winds, that they of ancient time called him the God and Lord of them: with no lesse consideration the prudent Mariner ought not to bee ignorant of them, forasmuch as the vniuersall benefit and commoditie of Nauigation consisteth therein: and to haue the better knowledge thereof, you shall vnderstand, that wind is a fruit of the Ayre, and a vapor of the Earth, the which by reason of his subtletie, piercth the Ayre, striketh it and inforceth it. Other say, that wind is Ayre, moued or tossed by the behement influence of vapours of contrarie qualitie: it is in Latine called Ventus, because it is behement and violent; whose force is so great, that it ouerthroweth not onely heapes of stones, or rockes, and casteth downe Trées, but also disturbeth the Ayre and the Earth,

Earth, and moueth the Seas. There are foure principall winds, which come from the foure Cardinall or principall points of the Horizon. We haue said that the Meridian Circle cutteth the Horizon in two points (that is) in the North and in the South, and the Equinoctiall cutteth it in other two, that is in the East and West: and from these foure points come these foure windes, whereof al the whole Scripture maketh mention. These foure winds, they in ancient time, named in this manner. That that commeth from the East, they called Subsolanus, which wee call the Leuant or East wind. That which commeth from the South, they named Auster, which we cal the Meridian or South wind. That which commeth from the West, they call Fauonius, which wee call the Ponent or West. That from the North, they named Septentrio, or Aquilo, or Boreas, which wee call North. To euery one of these foure winds, they adioyned two collaterall winds, in manner as followeth: That, that is from the East toward the part of the North, where the Tropicke of Cancer ariseth, or commeth forth, they called Vulturius: and that that is from thence toward the part of the South, where riseth the Tropicke of Capricorne, they called Eurus, also that is from the West toward the part of the South, where the Tropicke of Capricorne goeth downe, they call Aphricus, and that that declineth to the North, where the Tropicke of Cancer goeth downe, they call Caurus. The Collaterals of the North and the South, answere to the Circumferences of the Polar Circles, that, that is from the North towardes the Leuant or East, they call Aquilo, and that ꝑ declineth toward the West part, they cal Circius, that is from the South toward the East, Euro Auster, and toward the West Euro Aphricus: thus many hath Aristotle in his Metheors. With these twelue winds they sayled in old time, and made their Compasse by them.

The Hydrographers of late dayes, and such as are trauailed and exercised in sayling, agree with the Ancients, in the foure principall windes, although they haue changed the names, calling the Leuant, or Orient, East, the Ponent or

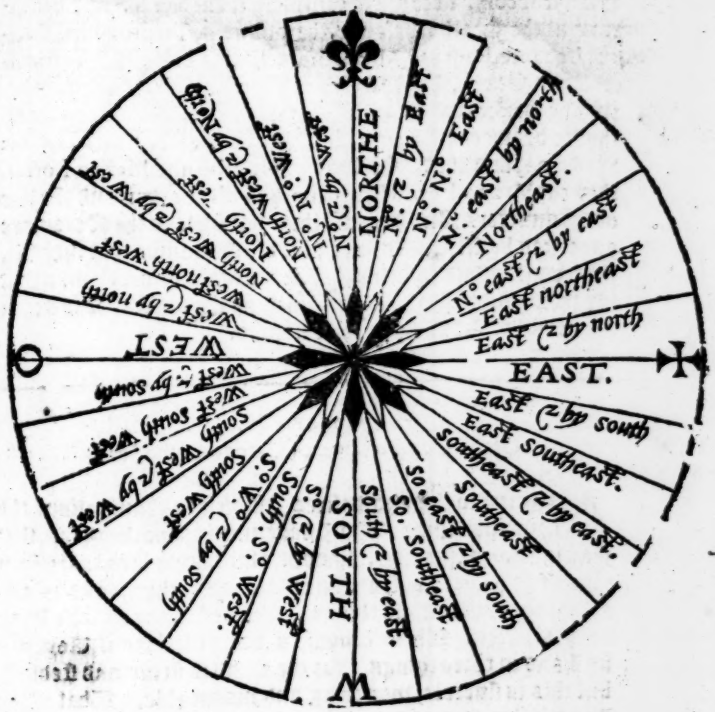
Occident, Weſt: the Septentrionall, Nozth, and the Meridionall, South. Betwéene theſe foure winds, they diuide euerie quarter of the Horizon into two halfes, made of the two néereſt, in this manner. Betwéene the Nozth and the Eaſt, taking name of them both, they named Nozth-eaſt. Betwéene the Eaſt and the South, they name the South-eaſt: and betwéene the South and the Weſt, South-weſt, betwéene Weſt and Nozth, Nozthweſt. Theſe eight winds in Nauigation, they call whole winds.

Betwéene theſe eight winds, they place other eight that are called halfe winds, which alſo are named of the two, that are néereſt vnto them. That that is betwéene the Nozth and Nozth-eaſt, they call Nozth Nozth-eaſt: Betwéene Nozth-Eaſt, and it, Eaſt Nozth-Eaſt, and ſo fozth of the other. Beſide theſe halfe winds, they haue other which they call quarter winds. Theſe take the name of the winds to the which they decline: as if to the quarter from the Nozth toward the Nozth-eaſt, they call it Nozth, and a quarter toward the Nozth-eaſt, that is Nozth and by Eaſt. And that that is toward the Nozth-weſt, they call Nozth, and a quarter toward Nozth-weſt. And ſo of the other, as ſhall be verified in the Figure following, whereof is gathered, that deuiding the eight principall winds into halfe winds, they are 16. And euery halfe wind diuided into other halfes, are in al 32. winds.

Some haue bin ſo curious, oz rather ſo vainely carefull, and to precíſe, that they haue diuided them into 64. And in the Cards that they haue, the confuſion of lines is greater then the profit that may be taken thereby.

The

The Demonſtration of Windes.



These names doe they vse that sayle by the Ocean Sea. And it seemeth they had their beginning of the Almaine or Flemish tongue, for these nations chiefly sayle in the Ocean, They that sayle in the Sea Mediterraneum, or Leuant Sea, call them by other names, taking originall of the Tuscan or Italian tongue. Or else that they haue denomination of the parts from whence they come, in respect of the Sea Mediterraneum, as the winde called Græco, because it commeth from

from Grecia and Libeico, becauſe it commeth from Lybia, and Syroccho, becauſe it commeth from Syria, and beginning at the North: theſe are their names, Tramontana, Græco, Leuante, Ponente, Maeſtro: and that is betweene Tramontana and Græco, they call Græco Tramontano, and that is betwéne Græco and Leuante, they call Græco Leuanto, and that is betweene Leuanto and Syroccho, they call Leuante Syroccho, and that is betwéne Syroccho and Mezzo Lorno, they cal Mezzo Lorno Syroccho, & ſo of the other: and the like of the quarters. And becauſe they that ſayle in the Ocean, are gouerned by Altitudes, wee will vſe the names that they vſe, where we intend to intreat of Altitudes, and every man ſhal vſe them as he liſteth, for as much as the difference is not in the windes, but onely in their names.

Chap. II.

Of the Compoſition of Cardes for the Sea.

According to the end deſired (which is Nauigation, the principall intent why I beganne this worke) I ſay, that Nauigation or ſayling, is none other thing then to iourney or voyage by water, from one place to another, and is one of the foure difficulteſt things, whereof the moſt wiſe King hath written. Theſe Voyages doe differ from Voyages by Land in three things: for the Land is firme and ſtedfaſt, but this is ſlidible, wauering and mooueable. That of the Land is knowne and termined by markes, ſignes, and limits, but this of the Sea, is vncertaine and vnknowne. And if in Voyages by Land, there are hilles, mountaines, rockes, and craggie places, the Sea payeth the ſame ſeuenfold with torments and tempeſts: therefore theſe Voyages being ſo difficult, it ſhall bee hard to make the ſame vnderſtood by words or writing. The beſt explication or inuention, that the wittes of men haue found for the manifeſting of this, is to giue the ſame painted in a Carde.

For

For the draught, or making whereof, it shall be requisite to know two things; whereof the one is, the right position of places, or placing of Countries and Coasts. The other is the distances that is from one place to another, & so the Carde shall haue two descriptions. The one that answereth to the position, shall be the windes, which the Mariners call Lines or points of the Compasse: and the other that answereth to the distances, shall bee the drawing and pointing of the coasts of the Land, & of the Ilands compassed with the Sea. To point the windes or Lines, you must take skinnes of Parchment or large Paper, of such bignesse as you will the Carde to be, and in it draw two right Lines with blacke inke, which in the middest shall cut or diuide themselues in right Angles, the one according to the length of the Carde, which shall bee East and West, and the other North and South. Upon the point where they cut, make a Center, and vpon it giue a prinie or hid Circle, which may occupy in manner the whole Carde. This Circle some make with lead, that it may easily bée put out: these two Lines diuide the Circle into foure equall parts, and euery part of these shall you diuide in the middest with a pricke or point. Then from one point to another, draw a right Diametrall Line with blacke inke, and so shall the Circle remaine diuided with foure Lines, into eight equall parts, which correspond to the eight windes. In like manner shall you diuide euery of the eight into two equall partes, and euery part of these is called a halfe winde. Then draw from euery point to his opposite Diametrall, a right Line of gréene or azure: likewise shall you diuide euery halfe winde in the Circle into two equall parts. And from these pointes which diuide the quarters, you shall draw a certaine right Line with red inke, which also shall passe by the Center, which they call the mother-Compasse, or chiefe Compasse of the Carde, being in the middest thereof, and so shall come foorth from the Center, to the Circumference, 32. Lines, which signifieth the 32. winds. Betide these said Lines, you shall make other

equall

equall distant to them, and of the selfe same colours, in this manner. From the points of the windes, and halfe windes that passe by the Center, draw certaine right Lines, that passe not by the Center, but bee equally distant to those that passe by the Center, & of the same colours & Equidistance, as are they that passe by the Center. And as these Lines concur together aswel in the Center, as in the points of the windes, and halfe winds, that are in the Circumference of the Circle, they shall leaue, or make there other sixteene Compasses, euery one with his thirty and two windes. And if the Carde be very great, because the Lines may not goe farre asunder, if you will make there other sixteene Compasses, you must make them betweene the one and the other of the first sixteene points, where the quarters are made with their winds as wee haue said. It is the custome for the most part to paint vpon the Center of these Compasses a flower, or a rose with diuers colours, and gold, differencing the Lines, and marking them with Letters and other markes, especially, signing the North with a Flower-Deluce, and the East with a Crosse. This beside the distinction of the Windes, serueth also for the garnishing of the Carde. And this for the most part is done after that the coast is drawne. And thus much sufficeth for the draught of the Windes.

The situation of the places, Ports and Ilands in the Carde, according to their proper differences, consisteth in the particular, and true relation of such as haue trauailed them, and therefore for this purpose it shall bee needfull to haue patterns of Coasts, Ports & Ilands, which must be painted in the Carde, and these of the best and most approoued to be true, and not onely to haue patterns well painted, but also it shall bee necessary to know the true Altitudes of the Pole, of certaine principall Capes, Portes and famous Cities. This done, they must bee translated into certaine thinne papers, and transparent that may bee seene through, and those of the best and finest that may bee had, anointing them with oyle of Line-seed, and then drying them at the Sunne. Then

take

take the patterne or Card that is to be translated, and reatch or stretch it forth vpon a Table. Then put the transparent paper vpon the one side of the patterne where you will beginne. And the paper beeing made fast vpon the patterne with plomets of Lead, or a little Waxe, that may easily bee taken of, you shall in the transparent paper marke with a fine penne, one East and West, and one North and South, or two, vpon those that are séene by the selfe same paper in the patterne. And this is called tracing or translating. In like manner shall you trace all the Coastes, Hauens, Ports, Ilands, Cities, Capes, and Riuers, as appeareth in the patterne, vnto the Rockes that come forth of the water, and the knowne Bankes. And because this paper doth not suffice, you shall put thereto another, and more as néede shall require. And beginne the translation in one, where the other endeth, vntill you haue translated all that you desire, not forgetting to make in euery one Lines of North and South, East and West, to serue for markes afterward. So that the Line of North & South, of the one paper, may ioyne close and euen, with the Line of the North and South of the other paper that is ioyned to it by Longitude.

And the patterne thus translated into these papers, you must put the ruled or lined paper or papers vpon a plaine, smooth and stedfast Table, where you shal stretch them forth & make them fast with plomets or weights, or nayle them to the Table by the sides or corners with smal nayles. Then vpon the said ruled paper, you shall put the paper that is translated from the patterne, in that side or part that is correspondent from the patterne to the ruled Carde, so that the Lines of East and West, North and South of the translation, may bee vpon the Lines that answere to them in the ruled Carde.

This paper thus made fast by the one side or part, you shall by the other side (that it may remaine in his place) put vnder it another fine paper, smoked or smyred on the neathermost part (which is that, that falleth vpon the ruled Carde)

Card) eyther with a linke, or with matches of pitch. Theſe thus ordered and made faſt one vpon another, you ſhal make a ſteele bodkin or wyre, with a ſmooth and blunt point, that it race not, or bore not the paper, and with it you ſhall draw, preſſing vpon all the tranſlation, and tracing it with diligence and diſcretion, marking euer how much in it is tranſlated from the patterne, ſauing the windes or Lines which the Mariners call Rumbos, and ſo ſhall remaine all the impreſſion of the ſmoke in the ruled Card, vpon the which with a fine penne, you ſhall trace with inke, which being dry, you ſhall with crummes of bread make it cleane from all the ſmoke, and ſo ſhall the coaſt appeare in the Card drawne with inke.

This done, then with a ſmall penne ſhall you deſcribe in the Carde, all the places and names of the coaſt in that part where they are, and as they are ſeene in the patterne. And firſt you muſt deſcribe in redde, the Ports, principall Capes, famous Cities, with other notable things, and all the reſidue in blacke. Then ſhall you draw or paint Cities, Shippes, Banners, and Beaſtes, and alſo marke the Regions, and other notable things. Then with colours and gold ſhall you garniſh and beautifie the Cities, Compaſſes, Shippes, and other parts of the Carde. Then ſhall you let forth the coaſts with greene, by the ſhore or bankes of the Lands, and make them fayre to ſight with a little Saffron or otherwiſe, as ſhall ſeeme beſt. Likewiſe ſhall you deſcribe certaine Letters with their ſignifications in this manner.

B. For a Bay, C. for a Cape, A. for an Angle, I. or Y. for an Iland, M. for a Mountaine, P. for a Porte, R for a Riuer.

Then in place where is more roome, or that is leaſt occupied, you ſhall draw two right Lines, equally diſtant, & the one no further from the other then halfe a finger, or little more, and ſo long, that betweene them may be marked at the leaſt three hundred leagues. And this the Mariners call the

trunke

trunke or scale of Leagues, and place it, or vse it in this manner. They take with the Compasse a hundred Leagues of the trunke of the Carde or patterne that is translated, and they set them iust betweene the two Lines, and this space they part by the halfe, and rest the foote of the Compasse in 50. and these diuided againe equally in two parts, they rest the Compasse in 25. and the 25. being likewise diuided, they rest in 12. Leagues and a halfe, and marke them as hereafter shall be declared.

The Carde being thus made, then to graduate it, or diuide it into degrées, you must drawe three Lines, which make right Angles with the Line of East and West, Equidistant to the Line of North and South, and they also shall be North and South. These shall bee drawne by the Ilands of Afores or Soria, or neerer to Spaine, or where the Carde shall be lesse occupied. And for this purpose, the one Line must be so farre distant from the other, that in the two spaces which they make, may be marked, in the one the degrées, and in the other, the number of them, conformable to the graduation of the patterne, as the numbers of degrées shew East and West, with the Ports, Capes and coastes in their proper altitudes.

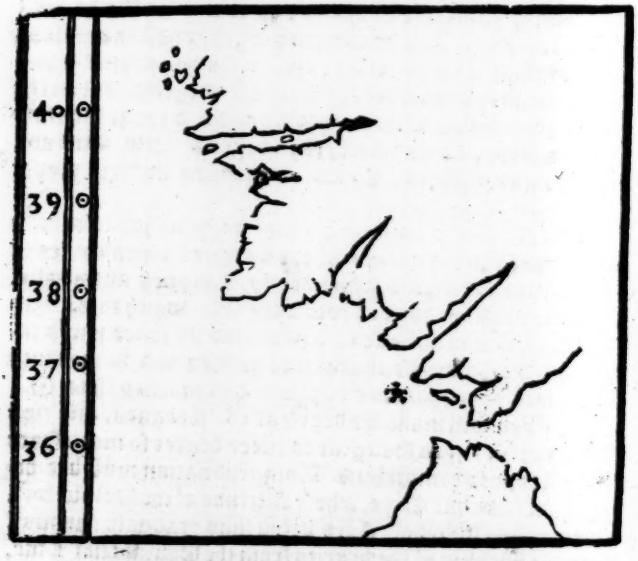
And if the Carde haue no graduation, you shall take with the Compasse in the trunke of the Leagues seuen spaces of 12. Leagues and a halfe, which are 87. Leagues and a halfe. And these must bee diuided into fiue parts, which come forth at 17. Leagues and a halfe for a part, and the foure parts taken with the Compasse, make foure degrées, and diuided into foure parts, euery part is a degrée and is marked thus, ⊙.

And if you will make the degrée at 16. Leagues, and two Terces or more, you shall giue to euery degree so much space as the Leagues comprehend. This graduation must bee begun from some one Cape, whose Altitude of the Pole is well knowne. And the whole Card being thus graduate, you must begin the number of the degrees from the Equinoctial Line, one, two, three, &c. toward the one Pole, and the like toward

the

the other: ſo that to the knowne Cape, may anſwere the number of his Altitude. And ſo ſhall you doe to the whole Carde. Alſo the Equinoctiall Line ſhall bee marked in his proper place.

And in like manner ſhall you marke the Tropickes according as they are in the Spheare. But foraſmuch as in Spaine, Cape Saint Vincent is the principall, they beginne there to make graduation, and number it in 37. degrées: and from thence toward the Pole Artícke, the degrées doe increaſe, and from thence toward the Equinoctiall Line, they diminiſh, from that Line to the Pole Antartícke, they increaſe againe, (as wee haue ſaid) as is contained in the Carde, and as appeareth in this demonſtration following.



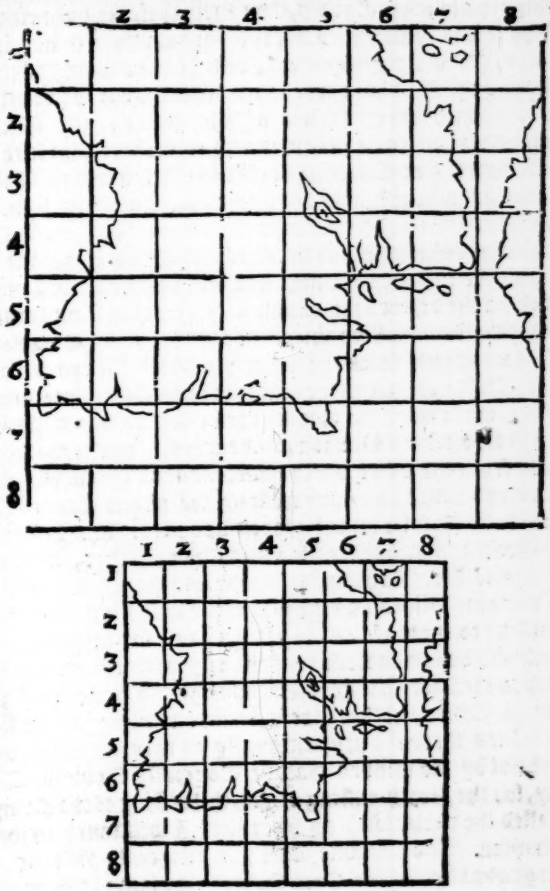
And if the patterne haue neither Leagues nor degrees, you

you muſt take or know the Altitudes of two Capes, that are North and South of the degrees, and the difference of the degrees of the Elevation, that is, from the one Cape to the other, ye ſhal diuide all that ſpace in ſo many parts, and ſo each one part ſhall be 20. Engliſh Leagues, or 17. Leagues and a halfe, as anſwering to one degrée. Or according to the opinion of the Leagues of the roundneſſe of the earth, as wée haue ſaid, as touching this in the 18. Chapter of the firſt part. In Spaine they vſe with the Compaſſe to take the ſpace that is from Cape S. Vincent, to the middeſt of the greateſt Iland of Birlinga, which they account three degrées: ſo that after 17. Leagues and a halfe for a degree, they are 52. Leagues and a halfe, and ſo much doe they put in this ſpace. Other put 50. Leagues, accounting after 16. Leagues, and two terces for a degrée: & in this manner they make of Leagues, degrées, & of degrees, Leagues. The ſayling Cardes haue no certaine bigneſſe limited them, becauſe they onely repreſent the Deſcription of the water and earth, and not the quantity, and for this cauſe ſome are pointed in great ſpace, and other in little. They that are in great ſpace, are more manifeſt, and more preciſe: and theſe the Mariners call Cardes of the largeſt pricke or draught. Some deſire rather to haue them in leſſe ſpace, becauſe they are briefer, and containe much in little roome, and theſe they call Cardes of the leſſe pricke. And if for any conſideration aforeſaid you deſire to reduce any Carde from the greateſt pricke to the leaſt, or contrariwiſe, you muſt paint onely the Coaſts and Ilands on a paper, in manner as you did in the ruled Carde of the Lines or windes, I ſay, let it be drawne vpon a paper, for deſtroying or tracing the patterne. And when it is traced onely with inke, then vpon that Draught ſhall you draw certaine right Lines equally diſtant, made all by one Compaſſe, according to the length of the Carde, and other Lines that may cutte them in right Angles: And likewiſe Equidiſtant, and of the ſame Compaſſe that the firſt are. Theſe two Orders of Lines, ſhall diuide all the ſuper-

ficiall part of the Carde into perfect ſquares or quadratures. And it is to be noted, that the nerer the Lines are ioyned together, and the ſquares the leſſe, ſo much the more perfectly may it bee reduced, and more eaſily. Then ſhall you take another paper, greater or leſſe then the Carde, according to the point that you deſire to reduce it vnto, and in the length and breadth thereof, you ſhall diuide ſo many ſpaces as are betweene the Lines of the other paper, and if it be greater, the ſquares ſhall bee greater, and if leſſe, leſſe. To keepe order in the correſpondence of the ſquares (which ſhall be a great light to tranſlate the one from the other) you ſhal number the orders of the ſquares, as thoſe of the Longitude, by the front or vppermoſt part: and thoſe of the Latitude by the ſide, as well in the one paper, as in the other, conformable: alſo, thoſe of the Front, from the left hand to the right, and thoſe of the ſide from aboue downeward. Then behold the Coaſt how it goeth by the ſquares of the firſt paper, and likewiſe the tracting or drawing in the ſquares of the ſecond, in the ſelfe ſame order and proportion, as it is there, and ſo ſhall it remaine reduced to the point which you deſire: and this ſhall ſerue for a patterne to ſet in the ruled Card.

Here

Here followeth the manner of tranſlating of the Carde from one forme into another, greater or leſſe.



Heere followeth a similitude of the Mariners Carde.

The Pilots and Mariners neither vse nor haue the knowledge to vse other Cardes, then onely these that are plaine, as I haue said. The which, because they are not Globus, spherical or round, are imperfect, and faile to shew the true distances: For in how much they depart from the Equinoctiall, toward which soeuer of the Poles, the Meridian Lines are contract narrower and narrower: In such manner, that if two Cities or points in the Equinoctiall should be distant of Longitude 60. Leagues, and in the selfe same Meridian at 60. degrées from the Equinoctiall, toward eyther of the Poles, should be other two Cities or points, they should be distant in Longitude but onely thirtie Leagues. And for the better declaration and vnderstanding hereof, I say, that if two Ships should depart from the Equinoctial, the one distant from the other a hundred Leagues by East and West, and that either of them should sayle directly by his Meridian toward the North. then when eyther of them hath the Pole ouer his Horizon, 60. degrees, the one shall bee distant from the other onely 50. Leagues, by the Paralell of East and West, as appeareth by the plaine Cardes, that they haue the selfe same hundred Leagues. And beside these considerations, one errour bringeth in another, and so another another. Whereof to speake any more heere, it shall be to certaine Pilots (as the Prouerbe saith) not onely to giue musicke to the deafe, or to paint a house for blinde men, but shall also bee an endlesse confusion. Furthermore it is necessary to consider, that good Cards ought to haue the Coasts, Ports, Cities, & other places, situate according to the winds or Lines thereof, proportionally as they are in the world, and not by the windes that the Compasse sheweth. This I say, for the North-easting or North-westing of the Compasse (called the variation) as hereafter I will touch in the fifth Chapter. And likewise shall you diligently obserue, that the graduation of the Card sheweth the same in their proper Altitudes. The Cardes that lacke this, ought to be corrected

and

amended by wiſe and expert men: ſauing that in the Leuant Sea (called Mare Mediterraneum) and in the Channell of Flaunders (called the narrow Seas) it is not conuenient for the Nauigation, that the Ports bee marked in the Cardes by the windes, which the Compaſſe sheweth, forasmuch as they ſayle not by the Altitudes of the Pole. Likewiſe it ſhall not bee inconuenient, but rather very neceſſary, to auoide ſo many errours, of the which doe flow great daungers, and ſuch a confuſion, that it were néedfull for certaine learned Coſmographers, and expert in the Art of ſayling, to veriſie the Altitudes of the Pole, that are of Ports, Capes, Ilands, and people by the coaſts of the Sea, and in like manner, truly to deſcribe the coaſts of the Land, eſpecially of the Nauigation of the Weſt Indies, or Mundo Nouo, where it hath pleaſed God that ſo many Nations and people haue receiued the Water of holy Baptiſme, comming to the knowledge of the true God, whereby the Chriſtian Empire is greatly amplified, beſide the great riches had by the ſaid Indies: And a further hope of many great beneſites to bee expected to the generall good of this whole kingdome, through the Plantation already happily begunne in Virginia, no doubt likely to proone as great a glory to our Nation, as the planting of the Weſt Indies is to the Spaniards, and the trade thereof in time to bee moſt beneficiall, both to our Marchants, and Mariners, to the great and vndoubted aduancement of this moſt excellent Art of Nauigation, by the ayde whereof, ſuch remote and vnknowne Countries and people are diſcouered, and wee made partakers of many rich commodities, which otherwiſe would obſcurely lye hidde vnto vs.

Chap. III.

Of the vertue and property of the Loadſtone, called in Latine *Magnes*, and in Spaniſh, *Piedramon*.

The Load-ſtone (as writeth Cardinall Cuſanus) hath ſubſtance, vertue and operation. His vertue is ingendered of ſubſtance, Eſſence or being, and of his Eſſence and vertue proceedeth his operation and effect in ſuch ſort, that this ſtone communicating his vertue to yron, by reaſon thereof, cauſeth the yron to moue, although betweene the one and the other be a cuppe or plate of ſiluer, or a Table or any other like thing.

The Attractiue, or drawing force of the Load-ſtone, cauſeth the nature of yron to bee and reſt in it, and that ſo firmely and quietly, that being naturally heauy and ponderous, it deſcendeth not, becauſe his nature reſteth not in himſelfe, but is vnite with the nature of the ſtone, which ſeemeth to extend it ſelfe, and as it were to caſt forth a liuely ſpirit of inchanting vertue. Inſomuch that (as we ſee by experience) by the ſaid vnion, it not onely diſtributeth his vertue to one yron, but that yron likewiſe to another, and that other againe to another, and ſo forth, vntill of many rings or linkes of yron be made a chaine.

S. Auguſtine (as hee writeth in his Bookes, De Ciuitate Dei) did maruaile, that hee ſaw an yron moue it ſelfe vpon a veſſell, by mouing the Load-ſtone vnder the veſſell.

It is called Magnes, becauſe the Inuentor or finder thereof was ſo named: (who as Plinie writeth) keeping Cattell in Eaſt India, had his ſhoes ſoled with plates of yron, and yron nayles, ſuch as they vſe in Gaſconie, and had in his hand a ſtaffe with a Pike, or hooke of yron, and reſting himſelfe vpon a quantity of this ſtone, could not remoue his feet, neither lift vp his ſtaffe. Then ſtaying awhile aſtoniſhed, as ignorant of the cauſe, at the length beganne to perceiue the property of the ſtone, and to vnderſtand the Attractiue

vertue

vertue thereof. The colour of it differeth not from yron, and was therefore called quicke yron or living yron. The beſt kinde of theſe ſtones, is of Azurine or blew colour, as the Sea ſometimes appeareth.

Of theſe are found fiue kindes or differences. The firſt is, of Ethiope. The ſecond of Macedonie. The third, of Lechio in Boœtia. The fourth of Troada, neere to Alexandria. And the fifth of Aſia: but at this day it is found in diuers other places. It is found alſo in many places in Spaine, as in the Hill Morena, neere vnto the Village of Calera, being of the order of Saint Iames, in the Prouince of Leon. Likewiſe in a Hill of Moron, in the territory of the Earle of Vrenia, is a great quantity thereof, and in diuers other places. The ſtone that wee moſt commonly vſe is of the Iland of Elua, of the Lord of Pomplina, which I iudge to bee better then that of Denmarke. This and the other haue vertue to draw yron vnto them. And true it is that Teanxedes writeth, that in Ethiope is found another kind of this ſtone, that putteth yron from it. Auerroes the Commentatour of Ariſtotle, denyeth that Magnes draweth yron vnto it, but ſaith, that yron by his naturall inclination, doth moue to the ſtone, as to his naturall place, by a certaine quality, which the ſtone impreſſeth in yron: and beſide this vertue and property, that it hath to draw yron vnto it, it hath alſo another, and that is, that it giueth vnto yron vertue and power, to ſhew the two pointes of the Horizon, where it cutteth the Meridian, that is, in the two windes of North and ſouth. Theſe vertues are found more intent in onely two parts of the ſtone: and theſe are euer oppoſite or contrary the one to the other, and ſo are they contrary in operation. For yron touched with the one part, and placed where it may remoue freely, will ſhew the North: and another yron touched with the other part, will ſhew the South. Finding this experience, may be knowne, what part of the ſtone anſwereth to the North, which the Mariners call the face of the ſtone, and likewiſe of the South.

This ſtone is ſo neceſſary, that without it, Nauigation ſhould be imperfect and vncertaine, becauſe it giueth light to the Needle and Compaſſe, which leadeth and guideth the Pilote, that he may goe certainely in the day, and not erre or wander in the night. Alſo it ſheweth and directeth to compaſſe the world, and to know the windes. And therefore for as much as the Compaſſe is ſo neceſſary, wee intend to ſhew the order and manner how it ought to bée made, for it may chance to fayle, or be loſt in the voyage.

Chap. IIII.

Of the making of the Mariners Compaſſe for Nauigation.

TAke ſuch paſte or paper, whereof Cardes are made, and make in it a Circle, of the quantity of a ſpanne, or little more or leſſe: In the which you ſhall paint the 32. windes with their colours, in ſuch order as we gaue in the firſt and ſecond Chapter of the windes, and of the Carde, not forgetting to marke the North with a Flower Deluce, & the Eaſt with a Croſſe: And more then this, may euery man garniſh and beautifie the ſame, as ſeemeth beſt to his fantaſie. Then on the lower or neather part of this paſte, you muſt draw a Line, which ſhall be directly vnder that of the North and South, which ſhall be the marke for the ſetting of the Irons and Steeles. Then ſhall you take a wyre of yron or ſteele, of the bigneſſe of a great pinne, or according to the bigneſſe of the roundneſſe of the paſte flower, roſe, or Flie, as it may be called. This wyre muſt be bowed double, ſo that euery of the parts may bee equally as long as the Diameter of the Flie, and a quarter part more. The ends or points of theſe yrons or ſteeles, muſt bee pinched together, and made cloſe, and open in the middeſt, the one from the other, vntill the ends come to bee equall with the extremities of the Diameter of the Flie, and ſo ſhall the ſteeles remaine in manner, in forme of an Egge. Theſe wyres or yrons muſt

muſt bee made faſt in the neather part of the Flie: ſo that their extremities, ends or points come preciſely by the Line of North and South.

And to fixe or faſten them ſo, they muſt bee couered with a thinne paper glued, leauing the points and ends vncouered: and thoſe ends muſt bee touched with the Load-ſtone, in this manner. The part that is vnder the Flower Deluce, muſt bee rubbed on that part of the ſtone that anſwereth to the North, as is ſaid in the Chapter before.

And this ſhall ſuffice for the perfection of the Compaſſe: Yet ſome there be, that for ſuperaboundance, do touch the other part of the Iron, with that part of the Stone that anſwereth to the South, although it may ſuffice to touch it onely with the other part. This touching of the Iron with the Stone, that the demonſtratiue or working vertue may ſhew it ſelfe forth, muſt be done with giuing certaine ſtrokes with the hammer, on that part of the Stone, wherewith the Iron muſt bee touched, that is to ſay, in the North part or the South: and from theſe will come forth of the Stone, certaine beardes, like ſmall Pickles; whereon you ſhall rubbe the point of the Iron, as you would whet a knife, and ſo ſhall certaine of the beardes of the Stone cleaue and ſticke faſt to the Iron. And the Irons thus touched with the beardes cleaning to them, you muſt take a pricke or point of Latyn, of Pyramidall, ſharpe, or Steeple forme, which is broad below, & ſharpe aboue toward the point: this is made round or eight ſquare, as ſeemeth beſt, and in the neather part or breadth, it muſt be boared (but not thorow) with a borer, which muſt alſo be of Pyramidall forme, and enter into the middeſt of the ſaid Pyramidall pricke or point of Latyn vnto the middeſt or ſomewhat more. This Pyramidall point (which the Mariners cal the Capitell) muſt bee of height halfe a finger breadth, or according as the Compaſſe ſhall bee, and muſt be put thorow the Center of the Flie, ſo that the point come forth on the higher part thereof, and muſt there be made faſt, and wel firt. Then ſhall you take a round bore of wood, within the which

the

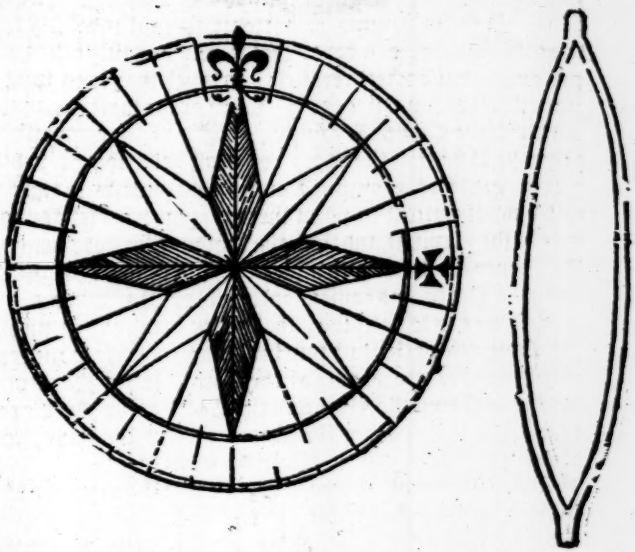
the needle may bee, not touching the sides of the same, and this must be of the height of the halfe Diameter of the Compasse. And the ground or bottome thereof must bee set to it, as the coueryng of a bore, that it may be easily taken of, & put on, to haue often recourse, to touch the yrons with the stone (which they call seeding) when neede shall bee, that the vertue of the Compasse fayle not. Also in the middest of the ground, or flowre of the bore, you must set a sharpe point or pricke, made of a wyre of Latyn: this must stand right vp, and vpon the pricke or point thereof, you must set the bored hole of the Capitell, and that the winde enter not aboue, you shall couer the bore with a glasse: And thus being touched with the North, and consequently all the other windes.

And here is to be noted, that after the yrons or néedle of the Compasse hath béene touched in any of these manners, if you bring the North part of the stone, to the North of the Néedle or Compasse, then will the North of the Needle come to it. And if you bring the North part of the stone, to the South part of the Néedle, it will flée from it.

And contrariwise, if you bring the South part of the stone, to the South of the Néedle, it will come to it, and if to the North, it will flée from it. This is vnderstood, the Néedle or Compasse standing as it should bee. And this also is a good signe, to know, which is the North part and South part of the stone.

Moreouer, this bore must be put within another bore, in the which it must hang vpon two Circles of Latyn, annexed the one within the other, which serue that the Compasse sway not, or hang toward the one side or the other, although the Shippe sway, and this bore also must haue his couer of wood, to kéepe the other. You shall likewise obserue that the point of the Capitell, and the hole thereof, and also the point or pricke vpon the which it resteth, bee vpright, and likewise the Rose, that it decline not to one part or other: and if it bee quicker then it ought to bee, then make the point that it goeth vpon somewhat blunter.

CHAP.



Chap. V.

Of the Effects or property that the Compaſſe hath to the Northeaſting or Northweſting, whereby is knowne the variation of the Compaſſe.

MAny and diuers are the opinions that I haue heard, and alſo read in certaine Writers of latter dayes, as touching the North-eaſting and North-weſting of the Compaſſe, and yet me ſeemeth that none doth touch the pricke, and few the white. They call it North-eaſting when the Needle ſheweth or pointeth from the North, which is his true mark, toward the North-eaſt; and North-weſting, when from the North,

Northe, it declineth toward Northwest. For the better vnderstanding of these differences, whereby the Needles differ or vary from the Pole, you must (being in the Meridian where the Compasses shew the Pole) imagine a point vnder the Pole of the world, and this point to be without all the Heauens, contained vnder the first moueable. The which point or part of Heauen hath a vertue attractiue, that draweth vnto it yron touched with the part of the Loadestone, correspondent to that certaine part of Heauen, imagined without or vnder all the Heauens, mooued by the first moueable. For if it were imagined to be mooued within any of the mooued Heauens, then the attractiue point by the moving of the first moueable, and consequently the Compasse, should make the selfe same mouing in 24. houres, which is neuer séene: & therefore this point is not in the moueable heauens, neither in the pole: for if it were in it, the Cõpas should not vary, Northeasting & Northwesting. Therefore the cause of Northeasting or Northwesting, or departing frõ the Pole of the world, is, that being in the said Meridiã, the attractiue point & the Pole, are in the selfe same, or in one Meridian: & the Compasse shewing the attractiue point, sheweth directly the Pole: and departing from the same Meridian toward the East (the world being round) the Pole of the world remaineth to vs on the left hand, and the point of the attractiue vertue shall bee on the right hand, which is toward the Northeast wind. And in how much more we shal saile toward the East, the distance shall appeare greater vnto vs, vntill wee come vnto the 90. degrees, and there shall bee the most and greatest Northeasting, & passing from thence further forward: it shall appeare vnto vs, that the attractiue point commeth nérer & nérer vnto the Meridian Line, & so much shall the Compasse go settring or amending the Northeasting, vntill it returne to the selfe same Meridian in the opposite, or contrary part from whence they came, or where they began, and then shall the attractiue point be directly to them vpon or against the Pole of the world, and the Compasse shall shew or point

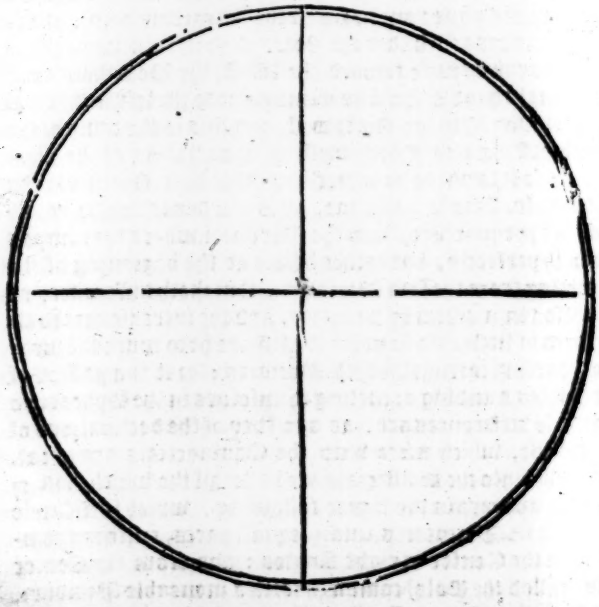
directly

directly toward it. And againe, passing further forward, the Pole of the world shall remaine to the right hand, and the point attractiue to the left hand, and so shall the Compasse beginne Northwesting, increasing it vntill it come from thence to the 90. degrees, and there shall bee the most of his Northwesting. For turning toward the Meridian from the Attractiue point, it shall goe amending or bettering, vntill it returne to the selfe same Meridian, from whence it departed, and there shall the Compasse shew the Pole of the world, directly by or ouer against the Attractiue point, which is perpendicularly vnder the Pole. And if from thence they should turne, to passe toward the West, the Pole should rest to the right hand, & the Attractiue point to the left, and so shal the variation be to the Northwest, and this is the cause of the North-easting and North-westing, or variation of the compasse. Also it is not to be vnderstood, that this North-easting & North-westing is vniforme, as is the departing (or according to the departure) from the Meridian, where the compas sheweth perfectly, but rather before at the beginning of the departing from the said Meridian, it maketh difference, or variation in a certaine quantity, and the increase that is afterward is little, and so much the lesse, in how much the more the departing is from the said Meridian: for it is a passion of the Circles, diuiding or cutting themselues in the Sphearе: so that these differences are, as are they of the declinations of the Sunne, which neere vnto the Equinoctials are great, and neere vnto the Solsticials are little: all the which shall euidently appeare in the figure following, which is a Circle diuided by 2. Diameters, into 4. equall parts, cutting themselues in the Center in right Angles: and from the Center point (called the Pole) commeth forth a moueable Meridian, & in it goeth a Compasse likewise moueable about the Circle: the Attractiue point is somewhat distant from the Pole of the world, and from it commeth forth a three, which must euer passe by the North and South of the Compasse. And the Compasse being in the Meridian of the point Attractiue, that

passeth

paſſeth by the Pole, ſhall ſhew the Pole, and without that ſhall goe North-eaſting, or North-weſting, ſo varying and departing from the true Meridian that commeth forth of the Pole of the world. It is the opinion of ſome Mariners, that the Meridian, where the Compaſſe ſheweth directly the Pole, paſſeth by the Iland of Sancta Maria, and other ſay, by the Iland of Caneruo in the Aſores.

Demonſtration of North-eaſting.



And whereas the inconuenience is manifeſt and notorious, the ſame muſt be remedied with prudence and time, & not to be negligent in the voyage, but euer to vſe and obſerue experience, more profitable then the ſubtile and curious queſtions

queſtions of the ſecret ſearchers of naturall things without experience, whereof reaſon taketh his principall ground. And therefore the wiſe Pilot ought to know by experience (as many of them doe not) how much a good Compaſſe doth varie, Northeaſting, or Northweſting from one place to another. So that to know how much the Compaſſe doth varie, Northeaſting, or Northweſting, from one place to another (as to ſay, halfe a quarter, or more or leſſe in quantitie, as they are diſtant from the ſaid Meridian, where the Compaſſes ſhew the Pole) he ſhall in the Nauigation take hèd, and wel conſider, in any ſuch Voyage, Northeaſting or Northweſting, in the points of the Compaſſe. And this ſhall be to ſayle truly by the points or Lines that the Card doth certainly ſhew. As for example, In ſayling from any Iland that is in the ſaid Meridian, or from any other part in ſèking of any Port, that is to them true Northeaſt, if by this way the Compaſſe ſhould Northeaſt halfe a quarter, then ſayling by the points or Lines of the Compaſſe, Northeaſt halfe a quarter to the North: their Nauigation ſhall bee (excepting other impediments) to the Northeaſt which the Card ſheweth: And by this point or line, muſt bee made the account of ſuch a Voyage. And ſo by the points of the Carde, they ſhall directly finde the Port that they ſought. And by this order ſhall they gouerne themſelues in all Nauigations. For the which it is conuenient that wiſe and expert Pilots ſhould make notes of obſeruations of Northeaſting and Northweſting, that is, from Port to Port, and to make compilations and gatherings of ſuch notes to carrie with them in their Ships for Regiments: and not to be buſie or curious to amend their Compaſſes, or with the ſtone to rubbe the Prons or Stáles, neyther on the one ſide or the other, from whence the Flower Deluce doth ſhew: for this ſhould cauſe many inconueniences. Neyther ought they to admit in their Cards two graduations: eſpecially, for that to know how much in euerie place the Compaſſe doth goe aſide, or varie from the true Meri-

dian,

dian may eaſily be made an Inſtrument to ſhew the ſame by the Sun in the day, and by the ſtars in the night.

Chap. VI.

Of the Introduction and Principles of the Art of Nauigation.

FOr aſmuch as now we haue the guide, which is the Compaſſe, it is conuenient to enter into the way, which is Nauigation. The which (as we haue ſaid) is to goe or paſſe by water from one place to another. And this preſuppoſed, I ſay, that he that deſireth to attempt Nauigations, muſt know two things which the Card ſhall ſhew him. The one is, by what point or Line he ought to ſayle, and this ſhall the Lines of the ſayling Card ſhew him. The other is, the Leagues of the diſtance, and this ſhall the Scale or trunke of the leagues ſhew, taking with a Compaſſe the diſtance of two places, and applying it to the Scale. The knowledge of theſe two things ought the Pilot to beare in memory, and to put them in effect, ought to direct his forthip to the ſelfe ſame Wind, which the Compaſſe doth ſhew. For the diſtance, he ought to know how much the Ship goeth dayly, well conſidering and obſeruing the winds, tides, currents, and all ſuch things as may be with him or againſt him. And according hereunto, he ſhall know how much he hath gone, and what remaineth for him to goe, and whether he be farre off, or neere vnto the place whither hee intendeth to ſayle: the which in Nauigation is the end deſired. And becauſe this eſtimation or computation cannot be iuſt and exact, eſpecially in a long Voyage, or in long time: it ſhall be conuenient that we rectifie or amend it, knowing the place where the Ship is, on the ſuperficiall part of the water, by the place that anſwereth to it in Heauen. This place of Heauen is knowen by the Altitude of the Pole, and by the Altitude of the Pole is knowne the Altitude of the Equinoctiall, and by the Altitude of the Equinoctiall and declination of the Sun, is knowne the Meridian Altitude, and con-

contrariwiſe, knowing the Meridian Altitude and declination of the Sun, is knowne the Altitude of the Equinoctiall, and by the Equinoctiall, the Pole, and by the Altitude of the Pole is knowne the Latitude: and this is the place that is deſired to be known. But forasmuch as the heauen is moueable from the Eaſt to Weſt, this place is not knowne as a certaine point, but is knowne as a line or paralell at a certaine diſtance from the Equinoctiall, and it is knowne in what point of this paralell the Ship is by the Altitudes that are taken from Heauen, and alſo by the Line that the Ship hath gone, as we will further declare in the 13. Chapter, of making a point or pricke in the Card, and in this manner you ſhall haue rectified the way that the Ship hath gone, and conſequently, the way that it hath yet to goe.

And forasmuch as theſe Altitudes are ſo profitable and neceſſarie, it ſhall be needfull to giue rules how wee may vſe them to our moſt commoditie: and for this is preſuppoſed to know, that all places ſituate on the ſuperficiall part of the Earth, and Water, eyther they are vnder one and the ſame Meridian, ſo that they haue one ſelfe ſame Longitude, and differ in Latitude, or are in one paralell, where they haue one ſelfe-ſame Latitude, and differ in Longitude, or are in diuers Meridians and paralels, where they differ in Longitude and Latitude. And I ſay, that if they haue one ſelfe ſame Longitude, they ſayle from the one to the other, by the Line of North, and South, and how many degrées doth varie the Altitude of the Pole, and of the Equinoctiall in Heauen, ſo many degrées haue they gone by Sea or by Land. If two places haue one ſelfe ſame Latitude, they paſſe from the one to the other by the Line of Eaſt and Weſt. And in ſuch manner of Voyage, the Altitudes doe not profit vs, becauſe there is no variation. If they differ or varie in Longitude and Latitude, they ſayle from the one to the other, by ſome of the other Lines. But there are more degrees that correſpond the way that the Ship maketh, then the degrees that varie the Altitudes of the Equinoctiall and the Pole.

And this difference shall bee greater, in how much the Line shall draw nére to the East and West, and how much it shall draw nére to North and South, it shall be lesse. Of the degrées or leagues, that answer to euery degrée of the variation of the Altitude, we will intreat hereafter in the 12. Chapter.

These Altitudes are knowne many wayes, but especially by 2. as by the Meridian Altitude and declination of the Sun (as we haue said) is knowne the Altitude of the Equinoctial, and by it the Altitude of the Pole. The second way, they are knowne by the Altitude of some fixt Starre, of those that are hid. And among many other, the North-star is taken, because it is nérest to the Pole. To know the Altitudes by the Sun, three things are necessarie, that is to say, an Instrument, the declination of the Sun, and rules. The Instrument to know the Meridian Altitude shall bee the Astrolabie, because it is most commodious for this purpose, whereof wee will intreat in the Chapter following. The declination of the Sun (which is to take it away, or to ioyne it with the Meridian Altitude,) we haue alreadie described in the third Chapter of the second part. The rule to know when the declinations must bee ioyned with the Meridian Altitude, or taken from it, wee will giue in the 8. Chapter. To know the Altitudes of the Pole, by the Altitudes of the North Starre, two things are necessarie, that is, an Instrument and rules. The Instrument wherewith the Mariners are accustomed to take the Altitudes of the North, they call Belestilia, which is a Crosse staffe, whereof wee will write hereafter in the 9. Chapter. And the rules of the Turne or Compasse, which the North-star maketh about the Pole, we will declare in the 10. Chapter.

Chap. VII.

Of the making and vse of the Astrolabie, with the which the Mariners take the Altitude of the Sunne.

TAke a plate of Copper or Lattin (which for this purpose is better then any other Mettall) of the bignesse that you

you desire to make the Astrolabie, and is commonly of the bignesse of a Span of the Diameter, and let it be of the thicknesse of halfe a finger at the least, for the weightier that it shal be, so much shall it be more steddie to make the Altitude. This plate must be made round by a Circle, leauing a comming forth of the Circle or corner, in the which you shall put a Ring or handle with a hole, whereby you may hang the Astrolabie, by a thred or line to take the Altitude.

After it is thus made, with the Ring or handle annered thereto, make it bright and smoth, polished on both the sides, and all of one equall thicknesse, that one side bee not heauier then another, which you shall trie in this manner: hang the plate by the Ring or hole that you haue made, and from the same hole hang a plomet of Lead, fastned to a haire, or fine thred of Silke. The Astrolabie thus hanging free, and at libertie with the plomet, if then the thred fall vpon the Center of the Astrolabie, it is wel, but if the thred do leane or swerue to the one side, or to the other, from the Center, then is that side thicker and heauier then the other, and must therefore be made thinner, vntill the thred fall iustly vpon the Center. This done, make a Circle vpon the said Center, a little within the Circumference of the Astrolabie. Then draw a Diameter from the Center of the hole, in the which the Ring or handle is, vnto the Center of the Astrolabie, trauersing or ouerthwarting the whole Circle. And this shall bee called the Line of the Zenith, or verticall point, which also shall be cut with another Diameter vpon the Center, making right Angles with it, and this Diameter shall bee called the Horizontall Line. These two Diameters shall diuide the Circle into foure equall parts. After this you shall make another Circle, so much more within the second, that betweene the Circumference of both the Circles, may bee contained the numbers of the degrees. Then (the Astrolabie hanging before you) you shall diuide the one (being the superiour and left part) first into three equall parts, and euery part shall containe 30. degrees. Then shall you diuide euery part of these into three

other equall parts, and they shall containe 10. degrees: and euery of these diuide into two parts, and they shall containe fiue degrées. This done, put a Ruler vpon the Center of the Astrolabie, applying it to euery of the points that diuide the said parts, and draw certaine lines that passe from the Circumference of the first Circle, vnto the lesse Circumference, and in the space of the lesse Circle write the numbers of the degrées, beginning in the Horizontall Line, and in that space put fiue, and in the second ten, and so forth of the other, vntill the 90. degrées end in the Line of the Zenith: then shall you diuide the spaces that are betwéne the first Circle and the second, euery space into fiue, which shall make the 90. degrées. The Astrolabie thus made, you shal make ỹ Alhidada or Label: for the which you shall take a Plate of Lattine, of the breadth of scarcely two fingers, and as thicke as the Astrolabie, also as long as the Diameter of the Astrolabie, and make a Line in the middest thereof by the Longitude, in the midst of this Line, make a Circle, so great that it may touch in the sides of the Plate, then cut off this Plate on the one side, that which it hath from the Line to the right hand, and on the other side, that that it hath from the Line to the left hand, leauing the Circle whole. This Line that shall passe by the Center of the Circle, is called Linea Fiduciæ (that is) the Line of confidẽce, which is that, that sheweth in the degrées, the Altitude that is taken. Then shall you take away the ends or corners of the Alhidada, that are without the Line, so that you touch not the Line. This done, you shall make two little rising or rayled Tables or Plates of the same height all, whereof the Astrolabie is made, and of the selfe same thicknesse that is the Alhidada or little lesse, and of the breadth of the Diameter of the Circle of the Alhidada, and let them be a thumbe in height or breadth. In the midst of these two places by the height, you shall make a Line. When these are made equall, and all their Angles right, in euery Line of these that you haue made, you shall also make two holes, equally distant from the sides or edges of the said Plates or Tablets. And of

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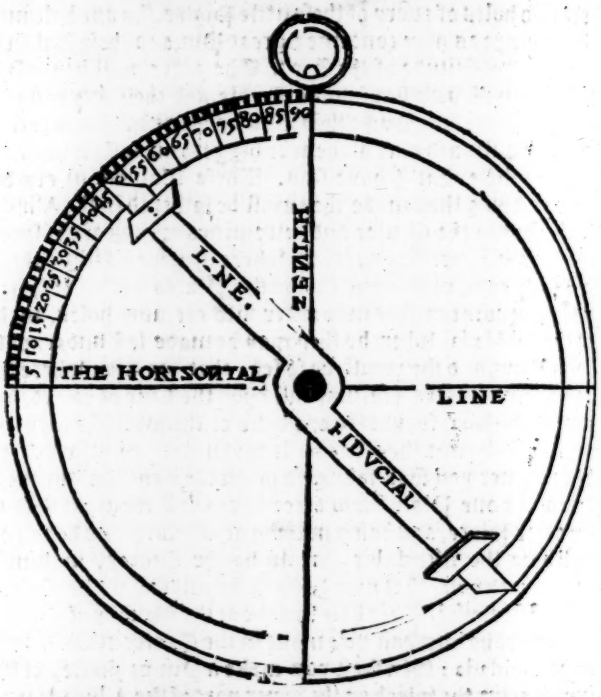
the two holes of euery of theſe little Plates, the one hole muſt be as bigge as may containe a great Pin, and theſe ſhal ſerue to take the Altitude of the ſtarꝛ. The other muſt bee ſo ſubtile and ſmall, as a fine ſowing Needle, and theſe ſerue to take the Altitude of the Sun: they muſt be made in ſuch manner, that the outward part of them be bigger, and leſſe within, of the quantitie that I haue ſaid. Theſe Tablets oꝛ erected plates being thus made, they muſt be ſothered in the Alhidada, betweene the Center and extremities oꝛ ends of the ſame, making in it certaine notches, where they may bee made faſt and ſothered, oꝛ leauing firſt in the Plates certaine ſharpe points oꝛ coꝛners, that may enter into certaine holes, made in the Alhidada, whereby they may be made faſt vnderneath with Pins, and they muſt be ſo ſet, that the Line where the holes of the Plates are, may fall vpon the Line of confidence of the Alhidada, ſo that the one halfe of the Plate be ſet vpon the Alhidada, and the other halfe without it, oꝛ at large. In like manner you ſhall take good aduertiſement, that the great hole of the one Plate ſtand directly againſt the great hole of the other Plate, and being nothing at all awꝛy: this done you ſhall bꝛze the Aſtrolabie thoꝛow by the Center, making a verie round hole, that may haue in the midſt of it, the Center of the Aſtrolabie. This hole ſhall be of the bigneſſe of a Gooſe quill: and the like ſhall you make in the Center of the Circle of the Alhidada: then ſhall you make a Pin oꝛ Naile, of the ſame Lattin, the which on the vpper part of the Alhidada may haue a plaine and round head: this Pin alſo ſhall bee verie round and ſmoth, that it may enter iuſt and cloſe into the hole of the Alhidada, and Aſtrolabie, and at the end oꝛ point thereof, comming foꝛth on the other ſide of the Aſtrolabie, muſt be a hole made ſideway thoꝛow the Pin, cloſe to the Plate of the Aſtrolabie, of the bigneſſe of a litle nayle oꝛ Pin, that may be put therein, to make faſt together the Alhidada with the Aſtrolabie, ſo that the Alhidada may thereby be turned round about the Aſtrolabie, as appeareth in this Figure following.



To take the Altitude of the Sun, hang vp the Astrolabie by the Ring, and set the Alhidada against the Sun, and rayse it, or put it downe in the quarter that is graduate, vntill the beames of the Sun enter in by the little hole of the other tablet or raysed Plate, and precisely by the other little hole of the other tablet. Then looke vpon the Line of Confidence, and how many degrees it sheweth in the quarter that is graduate (beginning from the Horizontall Line) so many degrees of height hath the Sun. In like manner shall you doe to take the Altitude of any other Star, looking thorow the great holes, because this may hardly be seene by the little holes.

CHAP

Chap. VIII.

Of the definition of the Altitude, and how the Altitude of the Pole may well be knowne by the Meridian Altitude, and eleuation of the Sunne.

IT is conuenient to define the Altitude, before wee giue rules of the vſe thereof. The Altitude of the Sunne, or the Moone, or of any other Starr, is the diſtance that is betweene it and the Horizon. And this ought to bee accounted by the degrées of the great Circle, which paſſeth by the Zenith, and by the Center of the Sun, or of the Moone, or of the Starr, vnto the Horizon. And the degrées that are from the Horizon to the Starr, or to the Sun, that is the Altitude, and the degrees that are from the Center of the Starr, or of the Sun, vnto the Zenith, is called the complement, or ſupplement of the Altitude. The Altitude of the Equinoctiall is euer counted by the Meridian. And the degrees of the Meridian, that are betweene the Equinoctiall and the Horizon, is the Altitude of the Equinoctiall, and other ſo manie are they that are from the Zenith to the Pole. For the Altitude of the Equinoctiall is equall to the complement of the Altitude of the Pole. The degrées of the Meridian that are betweene the Equinoctiall and the Zenith, is called the complement of the Altitude of the Equinoctiall, and is equall to the Altitude of the Pole. And although we haue defined the Altitude in generall, yet ſhall wee onely profit our ſelues by the Meridionall Altitude of the Sunne. The Meridian Altitude is the greateſt Altitude that the Sun hath euery day, and this ſhall be when the Center of the Sun is in the Meridian. And the Arke of the Meridian that is betweene the Horizon and the Sun, is the Meridian Altitude: So that when we ſay, the Altitude of the Sun is taken, it is vnderſtood at midday. The ſhadowes that the Sun then maketh, are in three ſorts: for eyther to vs it caſteth the ſhadow toward ỹ North part, or toward the South,

or perpendicular by a right-vp Line, so that at midday or none, nothing that standeth vpright, gineth any shadow at all. But forasmuch as there is such variation in declinations, Altitudes, shadowes, and Paralels, it shall bee necessarie to gine rules for all variations. And these shall be reduced into foure briefe and compendious rules, the which I haue here described, that the wittie may haue profit by them, and the rude learne them, not caring for the rules of the Mariners, because they are so long and tedious, for (as the Philosopher sayth) it is vainely done by many, that may well be done by few.

When the shadow shall be perpendicular, it is because the Sunne is in the Zenith, and 90. degrées about the Horizon. And then how many degrées of Declination the Sunne hath, so much shall we bee distant from the Equinoctiall, toward the part where the Sun declineth. And if it haue no declination, it and we shall be vnder the Equinoctial.

But when the Sunne and the shadowes shall bee to vs from the Equinoctiall, toward one of the Poles, we shal take away the declination from the Meridian Altitude, and then shall remaine the complement of the elevation, which complement being taken from 90. degrées, then shall remaine that which we be distant from the Equinoctiall toward the same Pole.

When the Sun declineth from the Equinoctiall, toward the one Pole, and the shadowes shall be toward the other, we shall ioyne the declination with the Meridian Altitude: and if all come not to 90. then subtract them from 90. degrées, and we shall haue the complement, and so much shall wee bee distant from the Equinoctiall, toward that Pole, to the which the shadow falleth: and if they bee more in number then 90. then the ouerplus of 90. shall we be distant from the Equinoctiall toward the Pole, where the Sun declineth, and if they be iust 90. we shall be vnder the Equinoctiall.

When the Sunne hath no declination, we shall be distant from the Equinoctiall, the complement of the Meridian Altitude toward the Pole where the shadowes are. By these rules,

rules, beſide (the vſe whereof wee haue ſpoken) may bee knowne how much is the greateſt declination of the Sunne, the Altitude of the Equinoctiall, the day, houre, and minute, when the Equinox was, the which is knowne as followeth.

Hauing taken the greater Meridian Altitude of the ſummer (which is in the beginning of Cancer) and the leſſe of Winter (which is in the beginning of Capricorne) taking away the leſſe from the more, the reſt is that, that is from Tropike to Tropike, and conſequently parted by the middeſt is the greateſt declination.

As for example, being in the City of London, I find the greateſt Meridian Altitude of the ☉ in the beginning of ♋. to be 62. degrées, and the leſſer Meridian Altitude, which is when the ☉ is in the beginning of ♑, to be 15. degrées, then taking 15. from 62. reſts 47. and ſo much is from Tropike to Tropike, and the $\frac{1}{2}$. which is 23. degrées, 30. minutes, is the greateſt declination.

Againe, the greateſt declination added to the leſſe Meridian Altitude, or ſubſtracting it from the greater Meridian Altitude, the reſt is the Altitude of the Equinoctial aboue the Horizon.

As for example, the greateſt declination 23. $\frac{1}{2}$. added to 15. the leſſer Meridian Altitude makes 38. $\frac{1}{2}$ or taking from 62. the greateſt Meridian Altitude, reſts 38. $\frac{1}{2}$. the height of the Equinoctiall in the City of London, or in any place where the Pole is eleuated, 51. degrees. 20. minutes: hereof it followeth, that when we take take the Meridian altitude at 38. $\frac{1}{2}$. that day is the true Equinoctial, which will bee the 11. of March, and the 13. of September this preſent yéere 1613.

So likewiſe when you take the height of the Sunne vpon the Meridian, at 62. degrées of Altitude, then is the ſun in the true Summer Tropike, or at 15. degrées of Meridian Altitude, then is the true Winter Tropike, the Summer Tropike being at the Suns entrance into ♋, and the Winter Tropike, at the Sunnes entrance into ♑, which is the 12. of Iune, and the 12. of December, this preſent yéere, 1613.

Here

Heere it is not vnnecessary to be noted, that for the working and obseruing of these, and such like propositions, there is to bee considered, that from the Equinoctiall to eyther of the Poles, is iust 90. degrées, and the height of the Pole is the eleuation thereof, and hauing taken the height or Altitude thereof, the same subtracted from 90. that which remaineth, is the eleuation or height of the Equinoctial aboue the Horizon: for it is certaine, that if the Pole be taken at 90. degrees aboue the Horizon, that is to say, if the Pole bee in the Zenith, then is the Equinoctiall in the Horizon, and looke how much the Pole is depressed from the Zenith, or verticall point ouer your head, so much is the Equinoctiall raised aboue the Horizon towards your Zenith: and by this reason you may know the Meridian Altitude of the same, by adding the Declination, with the eleuation of the Equinoctiall.

Chap. IX.

Sheweth the making and vse of the Mariners Crosse-staffe now commonly vsed.

Here in this Chapter had Martin Curtis set downe the Description and making of a Crosse staffe, hauing onely one Transame, as hauing in his time not the knowledge of any other: but the same being worne out of vse, and diuers farre better now knowne, I haue thought good heere to explane the making and vse of the latter, namely, of that with three Transames now most commonly vsed: for the making whereof, it is necessary to haue a Table-boord, &c. of such conuenient length and breadth, that vpon the superficies thereof a quadrant may be drawne, whose Semidiameter may containe the iust length or somewhat more, that you would haue your staffe to bee of: for the better effecting whereof, it is good to couer the said Table or boord with paper, and vpon the said paper, as I said, with a large paire of Compasses describe a quadrant in such manner, as is shewed

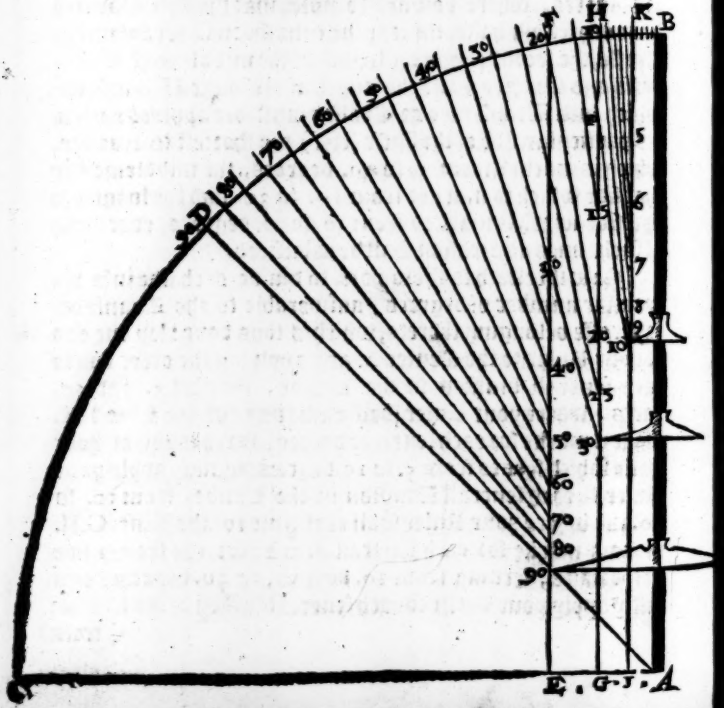
ed in the figure following, marked with the Letters, A. B. C that quadrant diuide into two equall parts, from the Center to the Limbe, with a Diagonal Line, protracted by the Line A. B. the halfe thereof, viz. that next vnto the perpendicular or subtendent, A. B. let it be diuided into 90. equall parts, from B. to D. and to the said Line, A. B. draw three Parallell Lines from the Limbe of the quadrant, to the base thereof, viz. the first distant from the said perpendicular, 5. parts, marked with I. B. the second 10. marked with G. H. and the third 20. marked with E. F. which three parallell Lines serue for the graduation of three sides of your Crosse-staffe: the first serving from 5. to 10. the second from 10. to 30. and the third from 30. to 90. degrées of Altitude, eyther of Sunne or Starres, where you are to note, that the first Parallell Line expresseth halfe the length of the shortest Transame or Crosse, the second, halfe the length of the middlemost Transame, and the third, halfe the length of the longest Transame, which said Transames or Crosses must bee applyed each to his particular side of the staffe (viz.) the shortest to that side, which is marked from 5. to 10. degrees, the middlemost to that side which is marked from 10. to 30. and the longest to that side which is marked from 30. to 90. degrees, euery one at such times as occasion shall be ministred.

Now it resteth to shew how to diuide each side into his peculiar number of degrees, answerable to the Transame or Crosse belonging thereto, which is thus done: lay one end of your Ruler to the Center A. and applying the other end to each seuerall diuision in the Limbe, betwixt 5. and 10. parts, where your Ruler shall each time cut the Line I. K. make a marke for each seuerall degree, for that side of your staffe which serues from 5. to 10. degrées: againe, apply your Ruler to each seuerall Diuision in the Limbe, from 10. to 30. and where your Ruler shall each time cut the Line, G. H. make a marke for each seuerall degrée: for the second side of the staffe, serving from 10. degrées, to 30. degrées, and lastly apply your Ruler to each seueral diuision of the Limbe:

from

from 30. to 90. & where it shal each time cut in the Line, E.F. make a marke for the seuerall degrées, for the third side of the staffe seruing from 30. to 90. degrées, vnto which the longest Transame is to be applyed. These 3. Lines being thus marked, if you apply the 3. sides of your staffe each to his peculiar Line, & diuide the said sides of it, thereby you shal haue your staffe accommodated, whereunto you may apply the Crosses each seuerally as you shall haue occasion to vse them, noting that the shortest Crosse is to bee vsed, when the Sun or Star is not aboue 10. degrees high, the middlemost, when the Sun or Star is not aboue 30. degrees high, and the longest Crosse, when the Sun or Star is betwixt 30. and 90. degrees high.

The Demonstration of the said Staffe.



The ſaid ſtaffe being thus furniſhed with ſeuerall degrees, if the Artiſan liſt to take the paines, hee may diuide each degrée into 4. 5. 6. 10. 12. or 15. partes, each part containing, 15. 12. 10. 6. 5. or 4. minutes, as hee ſhall thinke conuenient to bee comprehended within the length of the ſtaffe: which being ſo accompliſhed, it reſteth now to ſhew the vſe thereof, which is ſo commonly knowne vnto euery Ordinary Sea-man, that few wordes will ſuffice for the explanation thereof: being thus, hauing fitted that Croſſe to the ſtaffe, which in your iudgement wil beſt ſerue for your altitude deſired, ſet that end of the ſtaffe where the degrées do end, to the corner of your eye, right with the Center thereof, holding the Croſſe right vp and downe, and winking with your other eye, moue the Tranſame or Croſſe to and fro, till by the extreme ends thereof you may at once (with that eye, at which the ſtaffe is) ſee both the middle or Center of the Sunne or ſtarre and the Horizon, vz. the Sunne or ſtarre by the vpper end of the Croſſe, and the Horizon, by the lower end thereof, which being ſeene as is ſaid, there ſtay the Croſſe, and the number of degrees that is cut therewith: vpon the ſide of the ſtaffe belonging thereto, is the Altitude of the Sunne, ſtarre, &c. deſired: manifold are the other ſortes of Inſtruments, by which obſeruation may bee made eyther on ſhore or at the Sea, but this being moſt common in vſe, I haue onely ſet downe the deſcription and vſe thereof: Though I cannot but chiefly commend M. Wrights Sea-quadrant, as alſo another quadrant now much in vſe, whereby the ſunne is to be obſerued without looking thereat, with onely turning the quadrant towardes the Sunne, and looking vpon the Horizon, the quadrant lying ouer your ſhoulder with your backe towardes the Sunne, for the vſe of M. Wrights quadrant, hee hath written thereof very amply in his correction of errors in Nauigation, and for the other it is ſo eaſie that it needes no explanation: the vſe of the Sunnes altitude thus taken by obſeruation, is explaned at large in the third Chapter of the ſecond part.

CHAP.

Chap. X.

Of the Altitude of the Pole, knowne by the Altitude of the North-ſtarre.

TO knowe the paralell in the which the Shippe is, ouer and beſides the rules, there before the Altitudes of the Sunne, it is likewiſe knowne by the Altitudes of the Northſtarre. Theſe two manners are vſed, for that more credit is giuen to two witneſſes then to one: ſo that if by one ariſe any doubt, the ſame may be certified by the other, and alſo becauſe time may ſometime ſerue for the one, and not for the other, as to haue a cloudy midday or none, and a cléere night.

The Altitude is taken of the Northſtarre, which is a ſtar in the extremity or end of the tayle of the leſſe Beare, being a conſtellation, commonly called the Horne. For this Northſtarre (of the moſt notable ſtarres about the Pole) is néereſt vnto it, and ſhall therefore ſhew a leſſe Circle then any of the other, and ſo ſhall his Altitude differ little from the Altitude of the Pole. This Starre hath declination 87. degrees, and 8. minutes, and the complement to ninety (which are two degrees, and fifty two minutes) is his diſtance from the Pole. And although that many hold opinion, that it is diſtant more then three degrées, yet it is now proued by the dayly experience of many expert both Aſtronomers and Mariners, who by diligent obſeruations haue found the true places of the Starres, then héretofore: and among the reſt, it is moſt certaine, that the ſaid Northſtarre is but two degrees, and fifty two minutes from the Pole, with their Longitudes, Latitudes, Declinations, and right aſcenſions more perfectly, and preciſely then doe the Mariners: for they account not onely by degrées, but alſo by minutes and ſeconds. Therefore whoſoeuer will preciſely knowe it, let him take the higheſt Altitude of the Northſtarre, which is his being ouer the Pole, and the leſſe Altitude, which is his being

ing vnder it: then take away the leſſe from the more, and the halfe of that that remaineth, ſhal be the diſtance of that ſtarre from the Pole of the world.

And likewiſe by this experience may bee knowne the Altitude of the Pole, and what all the other ſtarres, that goe not downe vnder the Horizon, bee diſtant from it. Joyning the greater Altitude with the leſſe, and that ſhall amount therof, diuided by the halfe, ſhall bee the Altitude of the Pole, and taking away this Altitude of the Pole from the greater Altitude of the ſtarre, or the leſſe from the altitude of the Pole, the reſt that remaineth ſhal be the diſtance of the ſtarre from the Pole: and as the Pole is inuiſible, it cannot bee ſeene or knowne, when the North-ſtarre is higher and lower, except it bee by the meane of ſome other marke: and for this is conſidered the poſition of the former Guards or watch, being one of the two ſtarres called the Guard, which are in the mouth of the Horne: which how much the ſaid ſtarre is vnder or aboue the Pole, is knowne by often experience, and exact triall of the ſaid former Guard, being vpon any point of the Compaſſe, according to which diſtance of the North-ſtarre from the Pole, I haue here inſerted the height or depreſſion thereof, for any of the eight chiefe or Cardinall points: but for thoſe that deſire more preciſely for all the whole thirty two points, let them reſort to the Booke called, The Sea-mans Kalender, where their expectation may be fully ſatiſfied.

Common Rules.

The former Guarde being in the Eaſt, the North-ſtarre is in one Degree, and 37. Minutes vnder the Pole.

The Guard being in the North-eaſt, the North-ſtarre is two degrees, and fifty minutes vnder the Pole.

The Guard being in the North, the Starre is two degrees, and 24. minutes vnder the Pole.

The

The Guard in the North-west, the Starre is, 34'. vnder the Pole.

The Guard in the West, the Starre is one degree and 36'. aboue the Pole.

The Guard in the South-west, the Starre is two degrées and 50. minutes aboue the Pole.

The Guard in the South, the Starre is two degrees, 24. minutes aboue the Pole.

The Guard in the South-east, the said North-starre is 34. minutes aboue the Pole.

Note that these eight windes are made according to foure Lines: whereof two are right, which are North and South, and East and West, and the other two are crooked, which are North-east, South-west, and South-east, North-west. When the Guard and the North-starre shall bee in the right Line, it shall appeare cleere how they are, and when they shall be in the crooked Lines, it may bee séene, because the Guardes are the one by the other in a right Line.

Heere, according to the prescription of Martin Curtis, should haue followed an Instrument speculatiuely shewing the vniformity of motion, which the North-starre, with the Guardes make about the North-Pole of the world, which being that, it is false and erronious, and much different from the truth, as experience hath now truely taught vs, by the painefull indeuours of many both learned and well exercised in these moderne times, I haue thought rather better to omit it altogether, then by the sight thereof with his allegations (which doubtlesse in his time could not wel be disproued) to incite any through ignorance of the truth, to rest doubtfull of eyther, and in steade thereof to supply the vacancy, with those things, which are not onely necessary, but rather most néedfull for euery Sea-mans vse: as for the declination or distance of the said North-starre from the Pole, it hath beene recited at large in the former Chapter, and for the allowance that is to bee giuen thereto, eyther by adding or substracting according to the height aboue the Pole or depressi-

on

on beneath the Pole, it is ſet downe at large in my Booke called the Sea-mans Kalender for euerie ſeuerall point of the Compaſſe, in which reſpect to ſet the like downe here againe would be ſuperfluous, onely becauſe that the reſt of the fixed ſtarres are there ſet downe with their declination and right aſcenſion onely, without ſhewing the time of their comming to the Meridian, ſaue onely by their right aſcenſion, and the Table of the Sunnes right aſcenſion thereto adioyning, which is ſomewhat too intricate for many of the meaner capacities, to vnderſtand, for whoſe eaſe I haue thought good here to inſert a more particular Table of moſt of the principall of the ſaid ſtars, being of the firſt and ſecond magnitude.

Chap. XI.

Sheweth the Declination, with the points of riſing and ſetting of certaine of the moſt notable fixed Starres, with a perfect Table for the time of their comming to the Meridian, from fiue to fiue dayes, in euery Moneth through the Yeere.

The firſt ſtar in the Rams horne is a ſtar of the third bigneſſe, whoſe declination is 17. degrées, 17. minutes, northerly riſing in the Latitude of 51. degrées, or thereabouts, at North-Eaſt and by Eaſt, and ſets at North-Weſt and by Weſt.

2 Oculus Tauri, or the Buls eye, is a ſtar of the firſt bigneſſe, hauing declination, 15. degrées, 38. minutes northerly, and riſeth in the foreſaid Latitude, at E. N. E. Eaſterly, and ſets W. N. W. Weſterly.

3 Orions left foot, is a ſtar of the firſt bigneſſe, hauing declination 5. degrées, 56. minutes northerly, riſing E. B. N. Eaſterly, and ſetting W. and by North Weſterly.

4 Orions right ſhoulder is a ſtar of the firſt bigneſſe, whoſe declination is 6. degrees, 17. minutes northerly, riſing E. and by N. and ſetteth W. and by N.

5 The firſt in Orions girdle is a ſtar of the ſecond bignelle, whoſe declination is 38. minutes Southerly, and riſeth Eaſt, ſetting Weſt.

6 The great Dog is a ſtarre of the firſt bignelle, hauing South declination 16. degrées, 12. minutes, riſing aboue our Horizon, S.E. and by E. Eaſterly, and ſetting, S.W. B.W. Weſterly.

7 The little Dogge is alſo a ſtar of the firſt bignelle, hauing 6. degrées, 13. minutes of North Declination, riſing E. and by N. and ſetting W. and by N.

8 The brightelt in Hydra is a ſtar of the ſecond bignelle, whoſe declination is 6. degrées, 53. minutes, Southerly, riſing E. and by S. Eaſterly and ſetting Weſt B. S. Weſterly.

9 Lions heart of the firſt bignelle declination, 13. degrées 55. North, riſing E. N. E. and ſetting W. N. W.

10 The Lions taple is a ſtar of the firſt bignelle, whoſe declination is 16. degrées 50. minutes Northerly, and riſeth aboue our Horizõ N.E. ¢ by Eaſt, and ſetteth N.W. by W.

11 Virgins Spike is a ſtarre of the firſt bignelle, hauing South declination, 9. degrées, riſing Eaſt and by South, and ſetting Weſt and by South.

12 Betwixt both thighes is a ſtar of the firſt bignelle, hauing 21. degrées, 20. minutes, of North declination, and riſeth Northeaſt Eaſterly, ſetting Northweſt Weſterly.

13 South ballance is a ſtar of the ſecond bignelle, whoſe declination is 14. degrées, 14. minutes Southerly, riſing Eaſt Southeaſt, and ſetteth Weſt S. Weſt.

14 Scorpions heart is a ſtar of the firſt bignelle, hauing South declination, 25. degrées, 25. minutes, riſing S. Eaſt, and ſetting S. W.

15 The Eagles heart is a ſtar of the ſecond bignelle hauing 7. degrées, 54. minutes of North declination, riſing Eaſt and by North, and ſetting Weſt and by North.

16 Pegaſus ſhoulders is a ſtar of the ſecond bignelle, whoſe declination is 12. degrées 58. minutes, Northerly, riſing E. N. E. and ſetting W. N. W.

17 The

17 The Swans tayle is a ſtar of the ſecond bigneſſe, whoſe declination is 43. degrées, 54. minutes northerly, not ſetting at all in our Horizon.

18 The Wagoners right ſhoulder is a ſtar of the ſecond bigneſſe, whoſe declination is 44. degrées, 49. minutes, North alwayes aboue our Horizon.

19 Hircus the Goat is a ſtar of the firſt bigneſſe, hauing North declination, 45. degrées, 50. minutes: neyther riſing nor ſetting in our Horizon.

20 Lyra is a ſtar of the firſt bigneſſe, hauing North declination 38. degrées, 30. minutes, not riſing nor ſetting in our Horizon.

21 Perſeus right ſide is a ſtar of the ſecond bigneſſe, whoſe declination is 48. degrées, 22. minutes, not riſing nor ſetting.

22 Fomahand is a ſtar of the firſt bigneſſe, hauing South declination, 33. degrees, 15. minutes, riſing S. E. and by S. and ſetting S. W. and by S.

These other Starres following, neyther riſe nor ſet in our Latitude.

23 In the great Beares thigh is a ſtar of the ſecond bigneſſe, whoſe declination is 55. degrées, 58 minutes, northerly.

24 In the great Beares ſide is a ſtar of the ſecond bigneſſe, hauing declination northerly, 58. degrées 34. minutes.

25 In her backe is alſo a ſtar of the ſecond bigneſſe, whoſe declination northerly is 63. degrées, 55. minutes.

26 The formoſt Guard is a ſtar of the ſecond bigneſſe, hauing declination towards the North Pole 75. degrées, 49. minutes.

27 The Pole ſtar is of the third bigneſſe, hauing North declination, 87. degrées, 8. minutes.

A Table of the time of the foreſaid ſtars, comming to the Meridian.

	Rams horne.		Bulls Eye.		Orion l. foot.		Orion r. shoulder		Girt in Or. Gir.		Great Dogge.		Little Dogge.		Bright in Hydra		Lions heart.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
5	5	A 45	8	A 26	9	A 8	9	A 47	9	A 25	10	A 40	11	A 31	1	B 21	2	B 1
10	5	24	8	5	8	43	9	26	9	4	10	19	11	10	1	0	1	4
15	5	2	1	43	8	25	9	4	8	42	9	57	10	48	0	38	1	2
20	4	42	4	23	8	5	8	44	8	22	9	37	10	28	0	18	1	
25	4	21	4	2	7	44	8	23	8	1	9	16	10	7	11	A 57	0	4
30	4	1	4	42	7	24	8	2	7	41	8	56	9	47	11	37	0	2
5	3	38	6	19	7	1	7	40	7	18	8	33	9	24	11	14	0	
10	3	18	5	59	6	41	7	20	6	58	8	13	9	4	10	56	11	A 4
15	3	0	5	41	6	23	7	2	5	40	7	55	8	46	10	36	11	2
20	2	40	5	21	6	3	6	42	6	22	7	35	8	26	10	16	11	
25	2	22	5	3	5	45	6	24	6	2	7	17	8	8	9	58	10	4
30	2	10	4	51	5	33	6	12	5	50	7	5	7	56	9	36	10	3
5	1	52	4	33	5	15	5	54	5	32	6	47	7	36	9	28	10	1
10	1	34	4	15	4	57	5	36	5	14	6	29	7	20	9	10	9	5
15	1	16	3	57	4	39	5	18	4	56	6	11	7	2	8	52	9	4
20	0	57	3	38	4	20	4	59	4	37	5	52	6	43	8	33	9	2
25	0	39	3	20	4	2	4	41	4	19	5	34	6	25	8	15	9	
30	0	21	3	6	3	44	4	22	4	1	5	15	6	7	7	57	8	4
5	11	B 59	2	44	3	22	4	11	3	39	4	54	5	45	7	35	8	2
10	11	41	2	22	3	4	3	43	3	21	4	36	5	27	7	17	8	
15	11	22	2	3	2	45	3	24	3	2	4	17	5	8	6	58	7	4
20	11	2	1	42	2	25	3	4	2	42	3	57	4	48	6	42	7	2
25	10	44	1	25	2	7	2	46	2	24	3	39	4	30	6	25	7	
30	10	25	1	6	1	48	2	27	2	5	3	20	4	11	6	1	5	5
5	10	5	0	46	1	28	2	7	1	45	3	0	3	51	5	41	5	3
10	9	46	0	27	1	9	1	48	1	26	2	41	3	32	5	22	5	1
15	9	25	0	6	0	48	1	27	1	5	2	20	3	11	5	1	5	5
20	9	5	11	B 46	0	28	1	7	0	45	2	0	2	51	4	41	5	3
25	8	45	11	26	0	8	0	47	0	25	1	40	2	31	4	21	5	1
30	8	25	11	6	11	B 52	0	27	0	5	1	20	2	11	4	1	4	5
5	8	1	10	42	11	24	0	3	11	B 41	0	56	1	7	3	7	4	2
10	7	39	10	20	11	2	11	B 41	11	19	0	34	1	5	3	15	4	
15	7	19	10	0	10	42	11	21	10	59	0	14	1	52	3	55	3	4
20	6	58	9	39	10	25	11	0	10	38	11	B 53	0	44	2	34	3	2
25	6	37	9	18	10	0	10	39	10	17	11	32	0	23	2	13	3	
30	6	17	8	58	9	40	10	19	9	57	11	12	0	3	1	53	2	4

	Rams horne.		Buls Eye.		Orion l. foot.		Orion r. shoulder		Girt in Or. Gir.		Great Dogge.		Little Dogge.		Bright in Hydra		Lions heart.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
5	5 B	57	8 B	38	9 B	20	9 B	59	9 B	37	10 B	52	11 B	43	1 A	33	2 A	22
10	5	36	8	17	8	59	9	38	9	16	10	31	11	22	1	12	2	1
15	5	16	7	57	8	39	9	18	8	56	10	11	11	2	0	52	1	41
20	4	57	7	38	8	20	8	59	8	37	9	52	10	43	0	33	1	22
25	4	37	7	8	8	0	8	39	8	17	9	32	10	23	0	13	1	2
30	4	17	6	58	7	40	9	19	7	57	9	12	10	3	11 B	53	0	42
5	3	56	6	37	7	19	7	58	7	42	8	51	9	42	11	32	0	21
10	3	36	6	17	6	59	7	38	7	24	8	31	9	22	11	12	0	1
15	3	17	5	58	6	40	7	19	7	5	8	12	9	3	10	53	11 B	42
20	2	59	5	40	6	22	7	1	6	47	7	54	8	41	10	35	11	24
25	2	41	5	22	6	4	6	39	5	29	7	36	8	27	10	17	10	6
30	2	22	5	4	5	46	6	19	6	10	7	18	8	6	9	59	10	48
5	2	2	4	43	5	25	6	4	5	53	6	57	7	48	9	38	10	27
10	1	44	4	25	5	7	5	46	5	34	6	39	7	30	9	20	10	9
15	1	25	4	6	4	48	5	27	5	15	6	20	7	11	9	1	9	50
20	1	7	3	48	4	30	5	9	4	55	6	2	6	53	8	43	9	32
25	0	49	3	26	4	12	4	51	4	36	5	44	6	35	8	25	9	14
30	0	30	3	11	3	53	4	32	4	15	5	25	6	16	8	6	8	55
5	0	13	2	54	3	36	4	15	3	53	5	8	5	59	7	49	8	38
10	11 A	54	2	35	3	17	3	56	3	34	4	49	5	48	7	30	8	19
15	11	35	2	16	2	58	3	37	3	15	4	30	5	21	7	11	8	0
20	11	15	1	56	2	38	3	17	2	55	4	10	5	1	6	51	7	40
25	10	56	1	37	2	19	2	58	2	36	3	51	4	42	6	32	7	21
30	10	35	1	16	1	58	2	37	2	15	3	30	4	21	6	1	7	0
5	10	11	0	52	1	34	2	13	1	51	3	6	3	57	5	47	6	36
10	9	50	0	31	1	1	1	52	1	30	2	45	3	36	5	26	6	15
15	9	29	0	10	0	52	1	31	1	9	2	24	3	15	5	5	5	54
20	9	8	11 A	49	0	31	1	10	0	48	2	3	2	54	4	44	5	33
25	8	46	11	27	0	9	0	48	0	26	1	41	2	32	4	22	5	11
30	8	24	11	5	11 A	47	0	26	0	4	1	19	2	10	4	0	4	49
5	8	2	10	43	11	25	0	4	11 A	42	0	57	1	48	3	38	4	27
10	7	40	10	21	11	3	11 A	42	11	20	0	35	1	26	3	18	4	5
15	7	18	9	59	10	41	11	20	10	58	0	13	1	4	2	54	3	43
20	6	56	9	37	10	19	10	58	10	36	11 A	51	0	42	2	32	3	21
25	6	33	9	14	9	56	10	35	10	13	11	28	0	19	2	9	2	58
30	6	11	8	52	9	34	10	13	9	51	11	6	11 A	57	1	47	2	36

	Lyons tayle.		Virgins Spike.		Boots. thigh.		South ballance.		Scorpió heart.		Eagles heart.		Pegasus shoulder		Swans tayle.		Wagó shoul
	H.	M.	H.	M	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M	H.
	5	3 B	42	5 B	18	6 B	9	6 B	43	8 B	19	11 B	45	2 A	59	0 A	43	9 A
	10	3	21	4	57	5	48	6	22	7	58	11	24	2	38	0	22	9
	15	2	59	4	35	5	26	6	0	7	36	11	2	2	16	0	0	9
	20	2	39	4	15	5	6	5	40	7	16	10	42	1	56	11 B	40	8
	25	2	18	3	54	4	45	5	19	6	55	10	21	1	35	11	19	8
	30	1	58	3	24	4	25	4	59	6	35	10	1	1	11	10	59	7
	5	1	35	3	11	4	2	4	36	6	12	9	48	0	52	10	36	7
	10	1	15	2	51	3	42	4	16	5	52	9	18	0	32	10	16	7
	15	0	57	2	32	3	24	3	58	5	34	9	0	0	14	9	58	6
	20	0	37	2	12	3	4	3	38	5	14	8	40	11 B	54	9	38	6
	25	0	19	1	55	2	46	3	20	4	56	8	22	11	36	9	20	6
	28	0	7	1	42	2	34	3	8	4	44	8	10	1	24	9	4	6
	5	11 A	49	1	25	2	16	2	50	4	26	7	52	11	6	8	50	5
	10	11	31	1	7	1	58	2	32	4	8	7	34	10	48	8	32	5
	15	11	13	0	45	1	40	2	14	3	50	7	16	10	30	8	14	5
	23	10	54	0	30	1	21	1	55	3	31	6	57	10	11	7	55	4
	25	10	36	0	12	1	3	1	37	3	13	6	39	9	53	7	37	4
	30	10	18	11 A	54	0	45	1	19	2	55	6	21	9	35	7	19	4
	5	9	56	11	32	0	23	0	57	2	33	5	59	9	13	6	57	3
	10	9	38	11	14	0	5	0	39	2	15	5	41	8	55	6	39	3
	15	9	19	10	55	11 A	46	0	20	1	56	5	22	8	36	6	20	3
	20	3	59	10	35	11	26	0	0	1	36	5	2	8	16	6	0	3
	25	8	41	10	17	11	8	11 A	42	1	18	4	44	7	58	5	42	2
	30	8	22	9	58	10	49	11	23	0	59	4	25	7	39	5	23	2
	5	8	2	9	38	10	29	11	3	0	39	4	5	7	19	5	3	2
	10	7	43	9	19	10	10	10	44	0	20	3	46	7	0	4	44	1
	15	7	22	8	58	9	49	10	23	11 A	59	3	25	6	39	4	23	1
	20	7	2	8	38	9	29	10	3	11	39	3	5	6	19	4	3	1
	25	6	42	8	18	9	9	9	43	11	19	2	45	5	59	3	43	0
	30	6	22	7	58	8	49	9	23	10	59	2	25	5	39	3	23	0
	5	5	58	7	34	8	25	8	59	10	35	2	1	5	15	2	59	0
	10	5	36	7	12	8	3	8	37	10	13	1	39	4	53	2	37	11 B
	15	5	16	6	52	7	43	8	17	9	53	1	19	4	33	2	17	11
	20	4	55	6	31	7	26	7	56	9	32	0	58	4	12	1	56	10
	25	3	34	6	10	7	1	7	35	9	11	0	31	3	51	1	33	10
	30	4	14	5	50	6	41	7	15	8	51	0	17	3	31	1	15	10

Ianuarie.

Februarie.

March.

April.

May.

Iune.

	Lyons tayle.		Virgins Spike.		Boots thigh.		South ballance		Scorpió heart.		Eagles heart.		Pegasus shoulder		Swans tayle.		Wagóer shoulder	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
5	3 A	54	5 A	30	6 A	21	6 A	55	9 A	31	11 A	57	3 B	11	0 B	55	9 B	55
10	3	33	5	9	6	0	6	34	9	10	11	36	2	50	0	34	9	34
15	3	13	4	49	5	40	6	14	8	50	11	61	2	30	0	14	9	14
20	2	54	4	30	5	21	5	55	8	31	10	57	2	11	11 A	55	8	55
25	2	34	4	10	5	1	5	35	8	11	10	37	1	51	11	35	8	35
30	2	14	3	50	4	41	5	14	7	51	10	17	1	31	11	15	8	15
5	1	53	3	29	4	20	4	54	7	30	9	56	1	10	10	54	7	54
10	1	33	3	9	4	0	4	34	7	10	9	36	0	50	10	34	7	34
15	1	14	2	50	3	41	4	15	6	51	9	17	0	31	10	14	7	14
20	0	56	2	32	3	23	3	57	6	33	8	59	0	13	9	57	6	57
25	0	38	2	14	3	5	3	39	6	15	8	41	12 A	55	9	39	6	39
30	0	20	1	56	2	47	3	21	5	57	8	23	11	37	9	21	6	21
5	11 B	59	1	35	2	26	3	0	5	37	8	2	11	16	9	0	6	0
10	11	41	1	17	2	8	2	42	5	18	7	44	10	58	8	42	5	42
15	11	22	0	58	1	49	2	23	4	59	7	35	10	39	8	23	5	23
20	11	4	0	40	1	31	2	5	4	41	7	7	10	21	8	5	5	5
25	10	46	0	22	1	13	1	47	4	23	6	49	10	3	7	47	4	47
30	10	27	0	3	0	54	1	28	4	4	6	30	9	44	7	28	4	28
5	10	10	11 B	35	0	37	1	11	3	47	6	13	9	27	7	11	4	11
10	9	51	11	27	0	18	0	52	3	28	5	54	9	8	6	52	3	52
15	9	32	11	8	11 B	59	0	33	3	9	5	35	8	49	6	33	3	33
20	9	12	10	48	11	39	0	13	2	49	5	15	8	29	6	13	3	13
25	8	52	10	29	11	20	11 B	54	2	30	4	56	8	10	5	54	2	54
30	8	32	10	8	10	59	11	33	2	9	4	25	7	49	5	33	2	33
5	8	8	9	44	10	35	11	9	1	45	4	11	7	25	5	9	2	9
10	7	47	9	23	10	14	10	48	1	24	3	50	7	4	4	48	1	48
15	7	26	9	2	9	52	10	27	1	3	3	29	6	43	4	27	1	27
20	7	5	8	41	9	31	10	6	0	42	3	8	6	22	4	6	1	6
25	6	43	8	19	9	10	9	44	0	20	2	46	6	0	3	44	0	44
30	6	21	7	57	8	48	9	22	11 B	58	2	24	5	38	3	22	0	22
5	5	59	7	35	8	26	9	0	11	36	2	2	5	16	3	0	0	0
10	5	37	7	13	8	4	8	38	11	14	1	40	4	54	2	38	11 A	38
15	5	15	6	51	7	42	8	16	10	52	1	18	4	32	2	16	11	16
20	4	53	6	29	7	20	7	54	10	30	0	56	4	10	1	54	10	54
25	4	30	6	6	6	57	7	31	10	7	0	33	3	47	1	31	10	31
30	4	8	5	44	6	35	7	9	9	45	0	11	3	25	1	9	10	9

	Hircus.		Lyra.		Perſius r. ſide.		Foma-hand.		g. Beares thigh.		Beares ſide.		Beares backe.		Formoſt Guarde.		Pole Starre.	
	H.	M.	H.	M	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M	H.	M
	59	A 2	10	B 33	7	A 9	2	A 53	3	B 45	2	B 51	2	B 53	7	B 7	5	A
	10 8	41	10	12	6	48	2	32	3	24	2	30	2	32	6	46	4	4
	15 8	19	9	50	6	26	2	10	3	2	2	8	2	10	6	24	4	2
	20 7	59	9	30	6	6	1	50	2	42	1	48	1	50	6	4	4	
	25 7	38	9	9	5	45	1	29	2	21	1	27	1	29	5	43	3	3
	30 7	18	8	41	5	25	1	9	2	1	1	7	1	9	5	2	3	1
	5 6	55	8	26	5	2	0	46	1	38	0	44	0	46	5	0	2	5
	10 6	35	8	6	4	42	0	26	1	18	0	24	0	26	4	40	2	3
	15 6	17	7	48	4	24	0	8	1	0	0	6	0	8	4	22	2	1
	20 5	57	7	28	4	4	11	B 48	0	40	11	A 46	11	A 48	3	2	1	5
	25 5	39	7	10	3	46	11	30	0	22	11	28	11	30	3	44	1	4
	28 5	27	6	58	3	34	11	18	0	1	11	16	11	18	3	32	1	2
	5 5	9	6	40	3	16	11	0	11	A 52	10	58	11	0	3	14	1	1
	10 4	51	6	22	2	58	10	42	11	44	10	40	10	42	2	56	0	5
	15 4	33	6	4	2	40	10	24	11	16	10	22	10	24	2	38	0	3
	20 4	14	5	45	2	21	10	5	10	57	10	3	10	5	2	19	0	1
	25 3	56	5	27	2	3	9	47	10	39	9	45	9	47	2	0	11	B 5
	30 3	38	5	9	1	45	9	29	10	21	9	27	9	29	1	43	11	1
	5 3	16	3	47	1	23	9	7	10	0	9	5	9	7	1	21	11	1
	10 2	58	4	29	1	5	8	49	9	41	8	47	8	49	1	3	10	5
	15 2	39	4	10	0	46	8	30	9	22	8	28	8	30	0	44	10	4
	20 2	19	3	50	0	26	8	10	9	2	8	8	8	10	0	24	10	2
	25 2	1	3	32	0	8	7	52	8	44	7	50	7	52	0	6	10	
	30 1	42	3	13	11	B 49	7	33	8	25	7	31	7	33	11	A 47	9	4
	5 1	22	2	53	11	29	7	13	8	5	7	11	7	13	11	27	9	2
	10 1	3	2	34	11	10	6	54	7	46	6	52	6	54	11	8	9	
	15 0	42	2	13	10	49	6	33	7	25	6	31	6	33	10	47	8	4
	20 0	22	1	53	10	29	6	13	7	5	6	11	6	13	10	27	8	2
	25 0	2	1	33	10	9	5	53	6	45	5	51	5	53	10	7	8	
	30 11	B 42	1	13	9	49	5	33	6	25	5	31	5	33	9	47	7	1
	5 11	18	0	49	9	25	5	10	6	2	5	7	5	10	9	23	7	1
	10 10	56	0	27	9	3	4	47	5	39	4	45	4	47	9	1	6	5
	15 10	36	0	7	8	43	4	27	5	19	4	23	4	27	8	41	6	3
	20 10	15	11	A 46	8	22	4	6	4	58	4	4	4	26	8	20	6	1
	25 9	54	11	25	8	1	3	45	4	37	3	45	3	43	8	0	5	5
	30 9	34	11	5	7	41	3	25	4	17	3	23	3	25	7	39	5	3

Ianuarie. Februarie. March. April. May. Iune.

	Hircus.		Lyra.		Perſius r. ſide.		Foma- hand.		g. Beares thigh.		Beares ſide.		Beares backe.		tormoſt Guard		Pole ſtarre.	
	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.	H.	M.
	9	B 14	10	A 45	7	B 21	3	B 5	3	A 57	3	A 3	3	A 5	7	A 19	5	B 15
10	8	53	10	24	7	0	2	44	3	36	2	42	2	44	6	58	4	54
15	8	33	10	4	6	41	2	24	3	16	2	22	2	24	6	38	4	34
20	8	14	9	45	6	21	2	5	2	57	2	32	2	5	6	19	4	15
25	7	54	9	25	6	0	1	45	2	37	1	43	1	45	5	58	3	55
30	7	34	9	5	5	41	1	25	2	17	1	23	1	25	5	39	3	35
5	7	12	8	44	5	20	1	4	1	56	1	2	1	4	5	18	3	14
10	6	53	8	24	5	0	0	44	1	36	1	44	0	44	4	58	2	54
15	6	34	8	5	4	11	0	25	1	17	0	25	0	25	4	49	2	35
20	6	16	7	47	4	23	0	7	0	58	0	7	0	7	4	21	2	17
25	5	58	7	29	4	5	11	A 49	0	40	11	B 49	11	B 49	4	3	1	59
30	5	40	7	11	3	47	11	31	0	22	11	31	11	31	3	45	1	41
5	5	19	6	50	3	2	11	10	0	2	11	8	11	10	3	24	1	20
10	5	0	6	32	3	8	10	52	11	B 44	10	50	10	52	3	6	1	0
15	4	42	6	13	2	45	10	33	11	25	10	31	10	33	2	47	0	43
20	4	24	5	59	2	31	10	15	11	7	10	13	10	15	2	29	0	25
25	4	6	5	37	2	18	9	57	10	49	9	55	9	57	2	11	0	7
30	3	47	5	18	1	54	9	38	10	30	9	36	9	38	1	52	11	A 48
5	3	30	5	0	1	37	9	21	10	13	9	16	9	21	1	35	11	31
10	3	11	4	42	1	18	9	2	9	54	9	●	9	2	1	16	11	12
15	2	52	4	23	0	59	8	43	9	35	8	41	8	43	0	57	10	53
20	2	32	4	3	0	39	8	23	9	15	8	21	8	23	0	37	10	33
25	2	12	3	44	0	20	8	4	8	56	8	2	8	4	0	28	10	14
30	1	52	1	23	0	0	7	43	8	25	7	41	7	43	11	B 58	9	52
5	1	28	3	0	11	A 35	7	19	8	11	7	17	7	19	11	33	9	29
10	1	7	2	38	11	14	6	58	7	50	6	56	6	58	11	12	9	8
15	0	46	2	17	10	53	5	39	7	29	6	35	6	37	10	51	8	47
20	0	25	1	56	10	32	6	16	7	8	6	14	6	16	10	3	8	26
25	0	3	1	34	10	10	5	54	6	46	5	52	5	54	10	8	8	4
30	11	A 41	1	12	9	48	5	22	6	24	5	30	5	32	9	46	7	42
5	11	16	0	50	9	26	5	10	6	2	5	8	5	10	9	24	7	17
10	10	57	0	28	9	4	4	48	5	40	4	46	4	48	9	2	6	58
15	10	35	0	6	8	42	4	28	5	18	4	26	4	28	8	40	6	36
20	10	13	11	B 44	8	20	4	4	4	56	4	2	4	4	8	18	6	14
25	9	50	11	21	7	57	3	41	4	33	3	39	3	41	7	55	5	51
30	9	28	11	0	7	35	3	19	4	11	3	17	3	19	7	33	5	29

The vse of which former Table for finding of any the saide starres time of comming to the Meridian being in number 27. is thus: looke for the name of the starre at the head of the Table, and for the moneth at the side thereof, toward the right hand, the dayes of the said moneths there-against, being numbred, from 5. to 5. and right against the day therof, vnder the starres name, is the houre and minute that the saide starre comes to the Meridian, eyther before or after noone, the day and month desired, which to know whether it bee before or after noone, is noted by two Letters, A. and B. for if the Letter A. stand with or next before the numbers, it signifieth so many houres and minutes after noone, and if B. stand therewith, or next before, then it signifieth so much before noone, or after midnight, as for example. The tenth of February, I desire to know, at what time the South Wallance will bee vpon the Meridian. First, I looke for the name of the said starre in the head of the Table, and at the right hand thereof, for the tenth of February: right against which vnder the starres name, I finde 4. houres, 16. minutes, and the letter next before the same, is B. So I conclude, that the South Wallance shall be vpon the Meridian at 4. a clocke and 16. minutes before noone, the day and moneth aforesaid.

Againe the 15. of September, I desire to know at what time the shoulder of Pegasus will bee vpon the Meridian, against the 15. of September, vnder the name of Pegasus shoulder, is 10. houres, 39. minutes, and the Letter next before is A. therefore I say that at 10. of the clocke, and 39. minutes after noone, the said starre shall be vpon the Meridian, the day and moneth aforesaid.

This is plaine inough, from 5. to 5. dayes of euery moneth: but if you desire the like for euery day particularly of any moneth, as indeed it is very requisite, you see that the difference betwixt euery 5. day noted in the Table, is neere about 20. minutes, which is euery day 4. minutes that the starre comes to the Meridian sooner then other, and therefore if you take away for euery day that you are from the

day

day next before in the Table noted foure minutes, the remainder shewes your desire.

Example.

The seuenteenth of September, I desire the time of Pegasus, as before, and finding not the seuenteenth day in the Table, I take the next before, being the fiftenth. From whose number, being tenne houres, thirty nine minutes, I take away for two daies, the difference betwixt the fiftenth and the seuenteenth, eight minutes, so there rests tenne houres, thirty one minutes for the said starres comming to the Meridian, the said seuenteenth of September, &c.

Chap. XII.

Of the Composition and vse of an Instrument, by the which without obseruing the South Sunne, or midday, is knowne the Altitude of the Pole, and the houre that is.

We haue giuen rules, whereby the Pilot may know in what paralell hee findeth himselfe with his Ship. But he may not know this at all houres, for as much as for the Altitudes of the Sun it is necessary to obserue the midday iustly, and for the Altitudes of the North, it is necessary to obserue, that the formost Guard bee placed iustly with the North in some of the foure Lines of the eight windes. And ouer and besides the rules aforesaid, I haue thought good to describe an Instrument, by the which may bee knowne the paralell where the Ship is, and what the houre is at any time of the day by the beames of the Sunne.

Make a round plate of Lattyn, or other conuenient mettall, of the Diameter of a spanne or more: for the greater that it is, the more precise shall it be, and make it in two Diameters, that may cut themselues in right Angles vpon the Center: In the foure extremes or ends of these Diameters, leaue foure round punctes or points, that may serue for Aris. The one of these Diameters shall bee called the Aris of the world, and the other, the Line of East and West. This done, make

make of the same lattyn or semicircular pece of the thicknes of the plate, or little lesse, & of the breadth of halfe a finger, this must stand vpon an edge, so that the conuex part may come iustly with the halfe of the circumference of the plate, to the which it must bee nayled or fothered in the neather part of the plate, the semicircle being rayſed, and that the ends ther-of may come with the ends of the Axis of the world: and this semicircle shall you diuide into two equall parts, and euery halfe in 90. degrées, beginning from the halfe point, toward the end of the Axis of the world, which are the Poles.

In like manner shal you make 2. circular péces of the bignes of a péce of foure royals of plate, which they cal rundels, for the houres: these must bee made fast in the plate by the Poles of the world, which may hold or beare them by their Centers: and euery of these rundels must be diuided into 24. equall parts, and although not all, yet the vppermost part of the plate, and aboue in the highest point of these diuisions, you must write 12. because that there it shall shew the midday or noone, and from thence, the afternoone houres must begin their numbers toward the West part, and shal end fiue houres in the halfe or middest of the ioynt of the Circle with the plate: in the other ioynt of the other part, shall begin 6. of the houres before noone, and shal end 12. in the highest point. You must also make another semicircular pece of the breadth of a finger, this must be plaine or flat, & the concaue or holownesse thereof equall to the semicircle of the edge or side of the plate, & in the ends must haue 2. holes, wherin may iustly enter the points that come forth of the Circle for the houres which are the Poles of the world: also this semicircle must haue 2. Lines, one on the vppermost part, & the other on the neathermost, which may diuide the breadth into two equall parts: this halfe Circle likewise must be diuided into 2. equal parts, by Longitude with a trauersed Line, which shalbe called the Equinoctial, & from this Line to the inward part ther-of must be counted 13. degrées & a halfe toward the one part, and as much toward the other part of the 90. that euery halfe of the Circle containeth, and at euery part where end the 23.

degrées

degrees and a halfe, make a trauerſed Line, ſo that from the one to the other, may be 47. degrees. And in this ſpace ſhall you draw certaine Lines Equidiſtant with them of the middeſt, that they and the middle Line may diuide into 4. equall parts the breadth of the halfe Circle. Then loke in the Table of the declinations of the Sunne, what declination hath the 5. degree of Aries, and that ſhall you account from the Equinoctiall toward the one part, and as much more toward the other, making a Line that may reuerſe that of the middeſt, where that declination doth end, and touch in the other two Lines. And the ſame ſhall you doe at 10. 15. 20. 25. and 30. which is the ende of Aries, and beginning of Taurus, and then the Line ſhall trauerſe all the breadth: The like alſo you ſhall doe to Taurus and Gemini, then in the ſpaces write Caracts of the twelue ſignes, beginning Aries from the Equinoctial, toward the North Pole. And then doe Taurus and Gemini end in the greateſt declination, beginning Cancer in the other part of it: Then Leo and Virgo doe end in the Equinoctiall, where ſhall begin Libra, Scorpio, Sagittarius: and in the other part, Capricornus, Aquarius, and Piſces ſhall end in the Equinoctiall where Aries began: this halfe Circle muſt haue an opening or open place, euen and iuſt in the middeſt from the Equinoctiall, vnto ſomewhat more then the greateſt declinations, and muſt be a little broader on the inner part then without, and not ſo broad as may come to the two Lines, becauſe it would then take away the graduation of the ſignes: and in this open place muſt bee put a ſquare graine or ſtubbe, which on the inner part may come plaine with the halfe Circle, and on the vtter part may come forth a little, where ſhalbe naild a ſquare peece of Lattyn, of the breadth of the halfe Circle: this graine or ſtubbe being ſo nayled with a peece, muſt haue in the middeſt a hole, ſo ſmall, as may receiue a litile pinne, and by the Centre of this hole, muſt paſſe a Line, which ſhall trauerſe all the graine: and this Line ſhal ſerue to put the Sunne (which the hole repreſenteth) in the degree of the ſigne where it is: This halfe Circle where it goeth in the circumference of the

rundels,,

rundels, for the houres muſt bee filed on the one ſide vnto the Line that is in the middeſt, to marke it, and ſhew the number of it. For the placing or ſetting of this Inſtrument, you muſt cut a girdle, or ring of Lattyn, as thicke as the plate, and of the breadth of a finger, or little leſſe, and ſo large, that of it may bee made a Circle ſomewhat bigger then the plate, ſo that the plate and the Meridian may eaſily bee contained within it. This Circle ſhall bee called the Horizon, which muſt be diuided into foure quarters.

In like manner muſt be made two Semicircular peeces, and the ends of them muſt be nayled or ſothered in the points that diuide the quarters of the Circle, & diuide the one from the other in two equall parts, making right Sphericall Angles, and in this ioynt of theſe two peeces, muſt bee nayled or ſothered a Paſſell, the which at the one end is diuided into two branches or forkes. Then ſhall you make a baſe or foot for the ſame, which in the vppermoſt part thereof ſhall haue a concauity, or hollowneſſe, where may be ſet a ſayling Compaſſe or a needle, touched with the Load-ſtone, and couered ouer with a glaſſe. And on the higheſt edges of this baſe the two branches of the Paſſell ſhall bee made faſt, and this baſe with the Paſſell, the halfe Circle, and the Circle, ſhall be all one peece, which ſhall bee called the ſeate or frame of the Inſtrument. The Horizontall Circle in the ends of one halfe Circle, muſt haue two holes, in the which may enter the Axis that are made in the ends of the line of Eaſt & Weſt.

Alſo you muſt take good heed when you ſother or make faſt the Paſſell in the baſe, that the North and South of the plate or Horizon, come with the North and South of the needle that is beneath, hauing euer reſpect how much the needle doth vary from the Meridian, by North-eaſting or North-weſting. In the ioynt of the two halfe Circles vpon the Paſſell, muſt be a point (called the Inder or ſhewer) which ſhall ſhew in the halfe Circle, ſothered in the place on the neather part, the degrees that the Pole is rayſed aboue the Horizon.

For the perfection of this Inſtrument, it ſhall be conuenient to ſet the Horizon very plaine and equall at the time

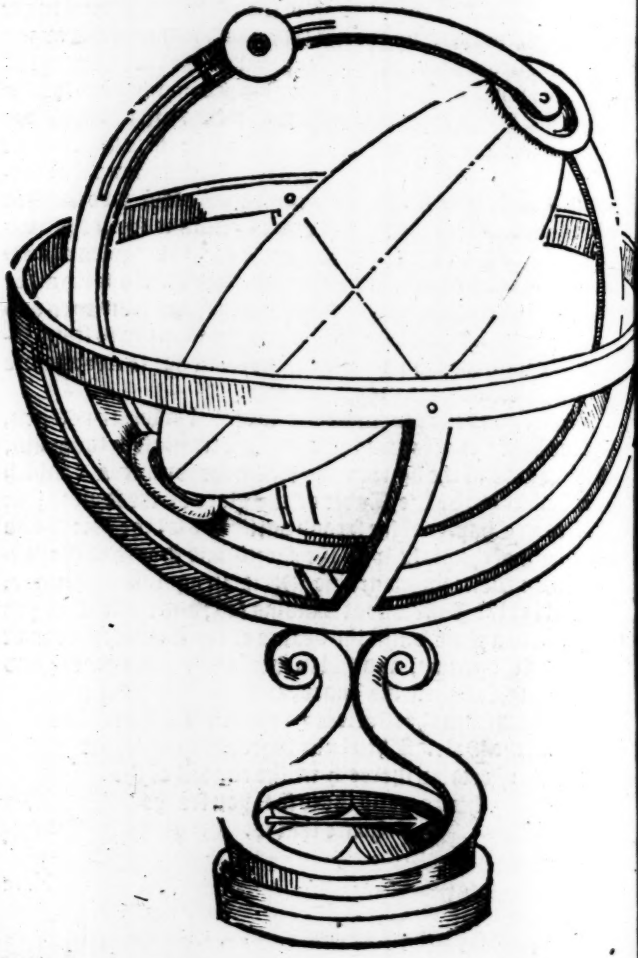
of

of the operation or practising with the Instrument, and this may bee done in two manners, whereof the one is, hanging by a fine threed at the Center of the plate, a plomet made somewhat pointed at the neather end, so that the Horizon standing plaine and leuell, the point of the plomet may fall vpon the point of the Inder, and this manner is good for the Land, but for the Sea, you shall sother the Horizon with two fires, little stubbes or ends comming forth: these shall be put in the two opposite holes of a Circle of mettall made somewhat strong, and this Circle must haue other two stubbes likewise comming forth, and equally distant from the two holes: these must bee sothered or nayled in two holes of another Circle in like manner, and the other Circle with other two stubbes inclosed in a bore: if then the bore stand euen and leuell, the poyse or waight shall cause the Horizon to stand leuell, although the Ship sway or roule from side to side: the vse of this Instrument is in this manner.

When you desire to know the Paralell in which you are, and the houre that is, put the Line that trauerseth the grain, in the degree of the signe in the which the Sunne is, (which you shall know by the Table of the place of the Sunne, in the second Chapter of the second part) and set the North and the South of the plate, with the North and South of the needle. Then turne the moueable Meridian against the Sunne, the foote of the Instrument standing fast, and rayse it, or put it downe in a plate, vntill the beame of the Sunne enter in at the hole of the graine, and fall in the Center of the graine, and standing, so behold the Inder, and how many degrées it sheweth from the Meridian, so much is the Altitude of the Pole. Then loke where the moueable Meridian sheweth in the rundell of the houres, and there shal you see the houre that is.

Here

Here followeth the Demonſtration.



Chap. XIII.

Shewing how many Leagues muſt bee runne vpon euery ſeuerall part of the Compaſſe, to raiſe or lay one degree of Latitude, and alſo how much you are departed from the firſt Meridian, in raiſing or laying one Degree vpon any of the ſaid points.

THis matter had Martin Curtis here well explayned, and ſet downe a demonſtration thereof, but indeed onely according to the account of Spaniſh Leagues, which being then well knowne vnto our Mariners, for that many of them did ſayle and kéepe their reckonings by Spaniſh Charts, cauſed the Tranſlatour of this worke (Richard Eden) not to alter his demonſtration, nor to ſwerue any whit from his direction therein: but now conſidering that our owne Countrey deſcriptions of Maps and Charts, are brought to ſuch a perfection, as in my conceit no Nation hath the like for true and perfect deliniation, and our ſcale of Leagues being diſſonant from the Spaniſh (viz.) their conſiſting of 17.½. Leagues to a degrée, and ours of 20. Leagues to a degrée, I thought it better to ſet downe that way which is moſt familiar, then by any vncouth or ſtrange way to bring them into a Labyrinth, albeit that I doe acknowledge their account, and ours to be all one, their 17. Leagues, and ½. containing 60. minutes, or one degree of a great Circle, and ſo likewiſe doth 20. of our Leagues, onely of ours of 20. Leagues to a degrée, is more eaſie and conducible then theirs to bee reduced into any denomination whatſoeuer: howbeit I purpoſe, God willing, in this Chapter to ſhew how to reduce Engliſh, Spaniſh, and Dutch Leagues, out of one forme into another: in the meane time, for the vnderſtanding of what is formerly promiſed, know that running Eaſt or Weſt, you neither raiſe nor lay the Pole, but it is ſtill of one and the ſame height vnto you, in whatſoeuer Meridian you are: likewiſe if you ſayle North or South, you neuer alter your longitude,

but if you be to the Northward of the Equinoctial, euery 20. Leagues that you sayle to the Southwards, doth lay or depresse the North-pole one degree, and so likewise euery 20. Leagues that you sayle to the North-ward, you rayse, or the Pole is higher aboue your Horizon one degrée: but if you sayle vpon any other point from the Meridian to the East-ward or West-ward, you must sayle a greater number of Leagues to rayse or depresse the Pole one degrée, and so consequently more or lesse, according as your course is distant from the North or South, towards the East or West, vpon any rombe or point whatsoeuer; where you are to note, that if you sayle North or South from the place where you are, you kéepe still one Meridian, differing onely in Latitude, but not in Longitude, and sayling East or West, you kéepe still one paralel, differing only in Longitude, & not in Latitude, but if you sayle vpon any other point, as is aforesaid, betwixt the North and East, North and West, South and East, or South and West, then in sayling any distance, you alter both Longitude and Latitude, more or lesse, according to the distance that you haue sayled: which being knowne, for one degrees difference eyther of Longitude or Latitude, may very easily be knowne: for much more, and for one degrées difference of Latitude and distance departed from the Meridian, at the saide difference of Latitude, vpon any of the said Intermedian points, being 7. this little Table will to the vttermost of your desire instruct you.

In

Insayling	To raise or lay one degree,	Departed from the Meridian:
North or South.	20. Leagues.	0. 0. Leagues.
N. b. E. N. b. W. N. b. W. N. b. E.	20. Leagues, and 1. mile.	4. Leagues.
N. N. E. N. N. W. N. N. W. N. N. E.	21. Leagues, and 2. miles.	8. Leagues, and one mile.
N. E. b. N. N. w. b. N. N. w. b. N. N. E. b. N.	24. Leagues.	13. Leagues, and one mile.
N. W. N. W. N. E. N. E.	28. Leagues, and one mile.	20. Leagues.
N. E. b. E. N. w. b. w. N. w. b. w. N. E. b. E.	36. Leagues.	30. Leagues.
E. N. E. w. N. w. E. N. E. w. N. w	52. Leagues, and a mile.	45. Leagues, and a mile.
E. b. N. w. b. N. E. b. N. w. b. N.	102. Leagues, and two miles.	101. Leagues.
East and West 20. Leagues makes a degrees difference of Longitude only in the Equinoctiall Circle.		

And now as I promised, I will shew you how to reduce Spanish or Dutch Leagues into English Leagues, and so likewise eyther of them into other, of all which at one time or other you may haue occasion: And first you must know, that 17. Leagues and a half Spanish, or 15. Leagues Dutch, are equall vnto 20. English Leagues, so many of eyther of them being equall vnto one degree of a great Circle, as are peculiarly appropriated vnto them, the manner of reducing them being as followeth, our English Leagues are most facile and easie, being that they haue such a correspondency to the degrees and minutes of the Equinoctiall, euery League valuing three English Miles, and euery Mile one minute of the Equinoctiall: and therfore when you would reduce Spanish Leagues into English, multiply your Spanish

Leagues by 20. and diuide the totall by 17. ½. the Quotient shewes your desire: and for Dutch Leagues, multiply by 20. and diuide by 15. For example, I would know how many English Leagues are contained in 7. Spanish Leagues: first I multiply 20. by 7. the totall is 140. which diuided by 17. ½. the Quotient is 8. so I conclude that 7. Spanish Leagues are equall vnto eight English Leagues.

Againe, if you would reduce 135. Dutch Leagues into English Leagues, multiply 135. by 20. and the totall 2700. diuided by 15. the quotient being 180. sheweth that there are so many English Leagues in 135. Dutch Leagues, and so may you reduce any number of Leagues, out of any one forme into another.

Chap. XIIII.

How to set or make a pricke in the Carde of Nauigation.

The Mariners call the pricking of a point in the Carde, to see and appoint in it, in what point or part of the Sea, the Ship is in Nauigation: for the performing whereof, it shall be requisite, that the Pilot know from what degree or how many degrées of the Altitude of the Pole he departed, and with what winde hee sayleth: and when hee desireth to know where hee is, let him know the Altitude of the Pole by some of the aforesaid rules. And if (taking the Altitude) hee finde himselfe in the same degrées, where hee was when he departed, his Nauigation hath beene from the East to the West, or else from West to East, and what hee hath gone, cannot bee knowne but by the iudgement of a wise and expert man, according to the swiftnesse or goodnesse of his Shippe, with consideration of the more or lesse time hee hath had, as wee haue said before in the first Chapter: but if hee finde himselfe in more or lesse degrées, let him take two payre of Compasses, and put the foote of one in the point or place where his ship was when he departed, and the other in

in the Line or wind by the which he sayleth. and likewise let him set the one point of the other Compasse in the graduation of the Card, in that number of degrees that he findeth the Altitude of the Pole, and the other point of the same Compasse in the next Line of East and West, and so with both the Compasses, one in the one hand, and the other in the other hand, let him goe ioyning them together, taking good heed, that the point of the Compasse doe not swerue from the wind whereby hee hath sayled, neyther the point of the other Compasse from the Line of East and West, where he set it.

And following those two Compasses by these two lines, vntill the points of the two Compasses ioyne (that is to meane, the point that was set in the place from whence he departed, and the other that was set in the degrees that were found) then where these two points doe ioyne, is the point where the Ship is. But (as wee haue said in the first Chapter) they must haue great respect to the winds and Seas, and other things, which experience sheweth them, to know if they haue gone directly by that Line, or if they haue fallen from it, and to what part, the which I remit to the iudgement of men of good experience. From thence forward they shall returne to kéep the same account, as when they departed from the Hauen, especially, when they change their course.

Chap. XV.

Of the making and vse of the Instrument generall, to know the houres and quantities of the Day, and at what Wind the Sunne riseth and falleth.

MAke a round Plate with a Ring or handle about, as in the Astrolabie, drawing a Line from the Ring downeward, passing thorow the Center, and another line that may cut it in right Angles thorow the Center: and this last Line shall be called the Horizon. Then shall you giue a Circle vpon the Center, leauing so much space betweene it and the edge of the Plate, that therein may be written the numbers of the

degrées: then also make another Circle somewhat more within, leauing likewise a space where the graduations may be diuided. This done, diuide one of the highest quadrants toward the left hand, into 90. parts, which shall be called the degrées of Latitude, beginning the number of them from the Ring, and ending the same in the Horizon. Then make another Rundel somewhat lesse then this, in such manner, that the degrées and numbers of the greater remaine vncouered. And diuide this lesse by two Diameters into foure equall parts, and at the one end of the one Diameter, leaue a point comming forth of the lesse Rundel, cut directly with the same Diameter by the one part, and this shall be called the Inder or Shewer. In this Rundel, you shall make a Circle halfe a finger lesse then the Rundel. Then with a Compasse take 23 degrées and a halfe from the Diameter, which signifieth the Equinoctiall, and whereas end the 23. degrées and a halfe for euery part make a right Line from one point to another, so that this bee a Line of 47. degrées, and as much more at the other end of the said Equinoctiall. Vpon euery one of these right Lines, you shall make a halfe Circle, and diuide euery of them into fiue equall partes, which may answere to fiue Signes, and euery Signe into 3. parts, which may answer to the tenths, or tenth parts of degrees: and if the Instrument be great, you shal diuide euery Signe into fiue or more parts, so that you make it perfect and precise. This done, from the points or prickes of the one halfe Circle, to the points of the other, draw certaine Lines which shall be equidistant to the Equinoctiall. In the ends of these Lines, betweene the lesse Circle, and the edge of the Rundel, draw also certaine Lines, which may reach vnto the beginnings and ends of the signes, and in the top of the ends, or ouer the ends of these Lines, make an Arke, so farre distant from the lesse Circle, as is the thicknesse of the edge of a peece of foure Royals of Plate, and in the space that is left, graduate the Signes from ten to ten, or as the diuision shall be. The space that remaineth from thence, to the edge of the Rundel, you shal diuide by the halfe,

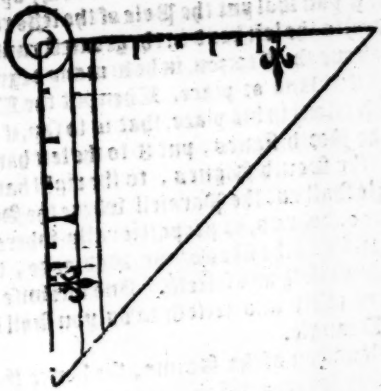
and

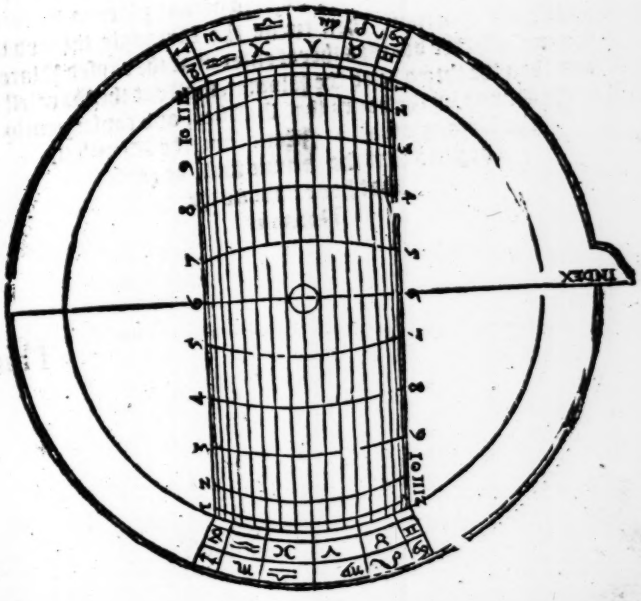
and in it shall be made twelue spaces, where you shall set the signes with their names or Characts orderly, so ỳ Aries be next vnto the Equinoctiall, then Taurus toward the part of the Inder, then Gemini, and turning toward the Equinoctial, Cancer, Leo, Virgo. Likewise on the other part of the Equinoctial, Libra, Scorpio, Sagittarius, & turning to the Equinoctiall, Capricornus, Aquarius, Pisces. And thus having signed the Zodiacke, you shal also signe or marke the houres, in manner as followeth.

Diuide the lesse Circle of this Rundel into 4 equal parts, so that every quarter may haue fiue parts. Reduce this diuision to the Diameter, putting the Ruler vpon the points, equally distant from the Horizon. And where it toucheth the Equinoctial, make prickes or points, so that the Equinoctial remaine diuided into twelue parts. Then vpon one of the Tropickes giue a Circle, which may haue the same Tropick for his Diameter. Diuide this Circle into twentie foure equall parts, and reduce these diuisions to the Tropicke, as is done in the Equinoctiall, and from one Tropicke to another: then the Equinoctials, and the Tropickes being thus diuided with these prickes or points, you shall passe with a paire of Compasses, by every point equally ordred from the Horizon, to the one and the other part, and these shall be called houres, writting in the ends of them their numbers, beginning the one part in one, and ending it in twelue. On the other part, begin the one in the opposite part, and end in twelue. This done, these Rundels shal be brought to their perfection. Moreouer, you shal make a Triangle with a right Angle, hauing two equal sides that may make ỳ right Angle. Euery of these sides must be as long as the Semidiameter of the greatest Rundell: also, vpon and about the right Angle, you shall make a little Circle, which shal haue the same Angle for his Center, and on the one side of this Triangle, set two raysed Plates, as in ỳ Astrolaby, on the contrary side of these raised Plates, must be a hole, so farre distant from the Center or Angle, as is the Semidiameter of the Circle of the lesse Rundell.

In this hole you muſt put a threed, hanging thereat a little weight or plomet onely ſufficient to hold the threed ſtraight, ſo that it cauſe nothing of the Rundels to turne or the inſtrument to decline. Furthermore, in a Circle as bigge as the leſſe of the leſſe Rundle, you ſhall diuide into 32. parts, the eight Winds and halfe winds, and quarters of winds. And being thus reduced to their Diameters (as is done in the Equinoctiall) you ſhall tranſlate them in the ſides of the Triangle, in the which by the Center of his little Circle, and by the Center of the Rundels, all the three peeces muſt be made faſt with an Aris or a naile, ſo that they may be turned about cloſe and very iuſt. Then put a Ring in the handle of the Inſtrument, whereby it may hang, as in the Aſtrolabie, and ſo ſhall the Inſtrument bee finiſhed and brought to perfection.

This is the trace or draught of the Inſtrument.

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To know what houre the Sun riseth and falleth, by the Instrument following, you shal put the Pole of the lesse rundel (which is the Inder) to the left hand in the greatest rundell in so many degrees aboue the Horizon, in how many degrées the Pole is rayled in that land or place. Then put the Triangle (which is the Horizon) in his place, that is to say, if the Sunne shall bee in the North signes, put it to the left hand, and if it shall bee in the South signes, to the right hand, and then the Triangle shall cut the Paralell where the Sun goeth in 10. or 20. or 30. degrées, or proportionally where it is, and there shall you see in the sides of the Zodiacke, the houres when the Sunne riseth and setteth. And likewise at what winde the Sunne riseth and setteth to vs, you shall se in the windes of the Triangle.

To know by the eleuation of the Sunne, the houre that is, put the Pole or Inder so farre distant from the Zenith or handle of the Instrument, as it is in that place or Paralell aboue the Horizon, then turne the Triangle toward the Sunne, vntil the beames therof enter in at the rayled Plates, and then the thréd with the Plomet, shall cut the Paralell of the Sunne, by the houre that shall bee, and consequently the Triangle shall be distant from the Zenith the degrées that the Sunne shall be rayled that houre aboue the Horizon.

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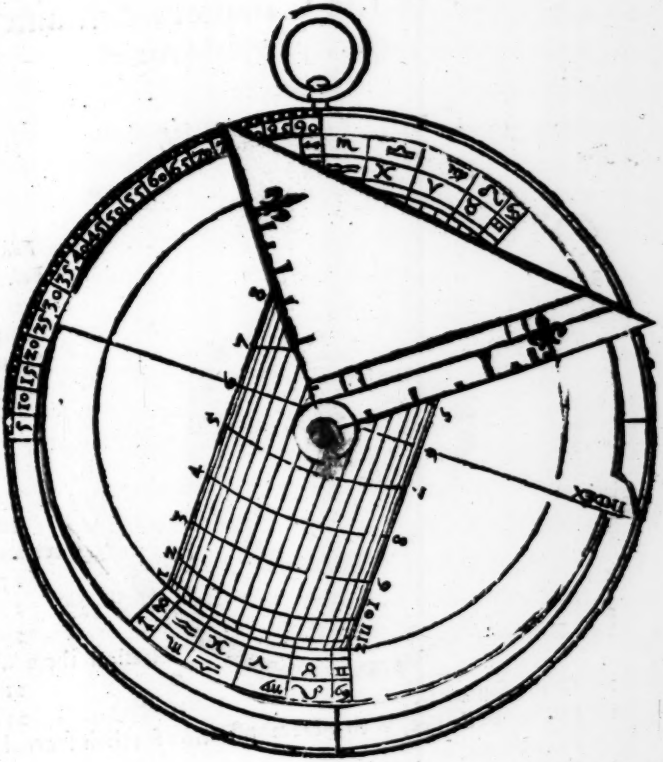
This is the Demonstration.



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